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# USSR Report

ENERGY

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## USSR REPORT

## ENERGY

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## ELECTRIC POWER

### SHUL'BINSK GES CONSTRUCTION PROGRESS URGED

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 21 May 82 p 3

[Article from Kazakh Telegraph Agency (KazTAG): "On Intensification of Construction of Shul'binsk GES"]

[Text] The Central Committee of the Communist Party of Kazakhstan and the Kazakh SSR Council of Ministers noted in their decree that construction of phase one of the Shul'binsk GES and preparation for flooding the floor of the reservoir are proceeding unsatisfactorily. The Kazakh SSR Ministry of Power and Electrification and the Irtyshgesstroy Construction Administration have permitted a lag in construction of the integrated hydroscheme and projects for the production base for contracting organizations. The Vostochno-Kazakhstanskaya and Semipalatinskaya oblast ispolkoms, the ministries of agriculture, fruit and vegetable farming and procurement and certain other ministries and departments of the republic have been slowly doing the job of transferring from the flood area inhabited places, underground mains and other entities, as well as of sanitary preparation of the reservoir's floor.

The Central Committee of the Communist Party of Kazakhstan and the Kazakh SSR Council of Ministers have decreed that the most important goal of the Vostochno-Kazakhstanskaya and Semipalatinskaya obkoms of the Communist Party of Kazakhstan and of oblispolkoms, the Ministry of Power and Electrification, the Irtyshgesstroy Construction Administration and other ministries and departments of the republic is to be regarded as speeding construction of the Shul'binsk GES, preparing the floor of the reservoir for flooding and ensuring entry into service of the first three units of this station by 1984.

A suggestion has been accepted from the Central Committee of the Kazakhstan Komsomol regarding declaring construction of the Shul'binsk GES a Komsomol urgent republic construction project and sending to this construction project, through Komsomol passes, skilled workers, as well as student detachments.

The Kazakh SSR Ministry of Power and Electrification and the Irtyshgesstroy Construction Administration must concentrate their main attention in construction of the Shul'binsk GES on putting into service the concrete mixing plant with a capacity of 360,000 cubic meters of concrete per year no later than August 1982, and in the third quarter, two boilers of the permanent boiler house. Together with the Kazakh branch of the All-Union Order of Lenin Planning and Surveying and Scientific

Research Institute imeni S.Ya. Zhuk (Gidroproyekt) it is necessary before 1 August 1982 to make a precise determination of the remaining amount of work for projects of the starter complex for putting the first three units of the GES into service by the deadline set, and to work out production schedules for work on these projects, and to take measures to perform in the current year construction and erection work to the tune of not less than 12 million to 13 million rubles. It has been decided to take measures for the timely entry into service of living space to accommodate workers and engineering and technical personnel assigned to the construction project.

The ministries of agriculture, fruit and vegetable farming, communications, power and electrification, and forestry, the Central Administration for the River Fleet under the Kazakh SSR Council of Ministers, the Vostochno-Kazakhstanskaya and Semipalatinskaya obkoms of the Communist Party of Kazakhstan and oblispolkoms must take urgent measures to speed the relocation of underground services, buildings and structures, production enterprises, residential buildings and other structures from the flooding area, as well as for carrying out sanitary measures on the reservoir's floor, and to guarantee completion of this work in the first half of 1984.

The Vostochno-Kazakhstanskaya and Semipalatinskaya obkoms of the Communist Party of Kazakhstan and oblispolkoms together with the Kazakh SSR Ministry of Agriculture have been entrusted with guaranteeing resettlement by the deadline set of people from the Shul'binsk GES reservoir flooding area.

The Ministry of Agriculture and Kazmezhkolkhozstroy [Kazakh Interkolkhoz Construction Organization] must intensify the rate of construction of new settlements, as well as of other projects to replace those to be moved from the reservoir flooding area, and must improve the quality of construction and erection work.

The Kazakh SSR Ministry of Fruit and Vegetable Farming has been assigned the task of carrying out in 1982-1984 the demolition of settlements and relocation of the pumping station with the pressure tunnel at the Zhanasemeyskiy sovkhoz in Semipalatinskaya Oblast, which lie in the flooding area. The Ministry of Drainage and Irrigation and Water Handling Facilities must, through the manpower of subdepartmental contracting organizations, relocate the pumping station and tunnel by the deadline set.

Assignments have been given also to other ministries and departments in connection with construction of the Shul'binsk GES. The Kazakh SSR Gosplan has been assigned the task of seeing to the allotment of expanded clay aggregate to the Irtyshgesstroy Construction Administration in 1983-1984, and Kazmezhkolkhozstroy the task of speeding work on construction of the new settlement for the Kolkhoz imeni Kalinin in Semipalatinskaya Oblast--prefabricated wooden houses.

By way of compensation for losses in agricultural production from flooding of lands by the Shul'binsk GES reservoir, the Kazakh SSR Ministry of Agriculture has been offered to construct irrigated sections on farms in Vostochno-Kazakhstanskaya and Semipalatinskaya oblasts.

It has been decided to assign in 1982 to the Irtyshgesstroy Construction Administration 15 cars for sale to production leaders in construction of the Shul'binsk

GES. The Kazakh SSR Ministry of Trade is to assign for these purposes 20 cars annually in 1983-1985.

The Gosplan together with the Semipalatinskaya Oblispolkom, the Kazakh SSR Goskino [State Committee for Cinematography] and the Irtyshgesstroy Construction Administration must solve the problem of constructing in 1983 a motion picture theater with 400 seats at the Shul'binsk GES settlement. The Vostochno-Kazakhstanskaya and Semipalatinskaya obkoms of the Communist Party of Kazakhstan and oblispolkoms, the Ministry of Power and Electrification, the Irtyshgesstroy Construction Administration and other ministries and departments of the republic have been assigned the task of taking measures to create the necessary housing and cultural and public services for builders of the Shul'binsk GES.

The Central Committee of the Communist Party of Kazakhstan and the Kazakh SSR Council of Ministers have expressed firm confidence in the fact that the party and Soviet agencies of Vostochno-Kazakhstanskaya and Semipalatinskaya oblasts and the teams of builders, having broadly launched a socialist competition, will apply all their efforts toward successful fulfillment of the quotas set for speeding construction of the Shul'binsk GES.

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## ELECTRIC POWER

### KHUDONI GES CONSTRUCTION PROGRESS REPORT

Tbilisi ZARYA VOSTOKA in Russian 26 May 82 p 1

[Article by ZARYA VOSTOKA special correspondents M. Gogokhiya and V. Lomtadze: "Khudoni GES: Second Level of Cascade, On High-Speed Schedule"]

[Text] Each day the work front expands ever more broadly in construction of the Khudoni GES. Now more than 250 people from the Ingurgesstroy Construction Administration for Subterranean Structures work here. Not a few crews arrived at the construction site from other organizations also.

The job has here has not yet gotten to erection of the dam, but already a precise determination has been made of the place where it will be built and all production documents have been prepared and refined. And now the "hottest" spot at the construction site--driving the drain tunnel for diverting the Inguri River. The drain tunnel will make it possible to begin construction of the dam. This is why builders have concentrated all their efforts precisely on this project. Each meter of rock does not yield easily to the tunnelers, but they have opposed the difficulties with high skill and an inventor's attitude toward solving problems originating in the construction process; and, the main thing, they have been helped by the experience gained in driving the 15-km power conduit for the Inguri GES.

The leading crews of tunnelers headed by K. Markhuliya and G. Dzhakhaya are showing examples of self-sacrificing highly productive labor. These teams are doing the job considerably ahead of schedule and have been overfulfilling each shift quota by 15 to 20 percent on average. They have already driven the main section of the tunnel. And what is especially important, the work pace of the leaders of the socialist competition for worthy celebration of the 60th anniversary of the formation of the USSR has now become the standard for the majority of participants in the construction project.

"To a certain extent we restructured the work," says Tunneling Crew Leader K. Markhuliya. "It used to be like this: The driller drills, the blaster blasts, a laborer removes the rock, a driver hauls it away, a fitter supplies compressed air and an injector fills with grout the space between the inner side of the tubbing and the rock. In short, complete division of labor. Each had his narrow specialty and did not interfere in the work of others. If his job is made ready for him, he works. This type of work was inefficient and therefore we decided in the crew to

master allied trades. The result of interchangeability was felt quite quickly: Labor productivity in the crew increased by almost four percent."

The example of these innovators was imitated also in G. Dzhakhaya's crew. All 37 members of this crew have now mastered several specialties. Improvement of organization of the work is helping all participants in construction of the Khudoni GES to increase their work tempo with each day and to achieve record figures.

Builders from the Grazhdanzhilstroy Administration working on reconstruction of the Dzhvari-Khudoni highway have considerably overfulfilled their plan quotas. They are expanding the carriageway by more than 3 meters, are concreting the abutment walls and are ensuring reliability of the alignment. Inspired by the decisions of the May plenum of the CPSU Central Committee, crews of concrete layers have widely launched a socialist competition for ahead-of-schedule completion of work on reconstruction of the highway.

Work is under way at full speed also on construction of the settlement for hydraulic power personnel and residences and a hostel are being erected. Motor transport personnel from the Khudoni truck convoy are also making a significant contribution to implementation of the designated construction program for the hydroelectric station. Since the beginning of the present year they have completed an amount of freight shipments considerably exceeding the plan quotas.

"Especially important to us now is to achieve total mutual understanding among all participants in the construction project," says Ingurgesstroy Construction Administration for Subterranean Structures Director M. Chaava. "Without it we are not able to complete the preparatory work for construction of the station by the deadline set. It is necessary also urgently to solve certain problems associated with improvement of supplying sections with building materials and to provide them with gear and equipment."

These problems are a matter of first-level importance to builders, but they are being solved already now. As reported to us by the party's Zugdidskiy Rayon Committee, builder's will be supplied with everything necessary in the next few days.

Construction of the Khudoni GES is continuing. Each day here brings new news regarding the high results of the work of crews and sections. And this makes it possible to hope that the entire designated program of preparatory work will be completed ahead of time.

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## ELECTRIC POWER

### NUCLEAR POWER PLANT INDUSTRY TECHNOLOGICAL PROBLEMS

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 6, Jun 82  
pp 17-21

[Article by Yevgeniy Dolbenko, USSR Lenin Prize winner, general director, Scientific Production Association for Machine Building Technology, TsNIITMASH [Central Scientific Research Institute of Machine Building Technology]]

[Text] The "Main Guidelines for the Economic and Social Development of the USSR for 1981-1985 and for the Period to 1990" call for a high rate of development of nuclear power. It basically must make possible a growth in the production of electric power in the European sector of the USSR.

A coordinated strategy is being carried out for interaction between CEMA member countries in the field of nuclear power. It is defined by the longterm special-purpose program of cooperation endorsed in 1978 at the 23rd CEMA Session meeting. Also serving this purpose is the "Agreement Regarding Multilateral International Specialization and Cooperation in Production and Supplying Equipment to One Another for Nuclear Power Plants for the Period 1981-1990" signed in June 1979 by the People's Republic of Bulgaria, Hungarian People's Republic, GDR, Polish People's Republic, Socialist Republic of Rumania, USSR, CSSR and Socialist Federal Republic of Yugoslavia.

Cooperation in the production of equipment for nuclear power plants (50 percent of the basic equipment will be made at USSR enterprises) includes about 50 large associations and enterprises of CEMA member countries and of the Socialist Federal Republic of Yugoslavia.

In the area of science and engineering an agreement and program of cooperation are in effect on the problem of "Mastery of Power Units with 1000-MW (Electrical) Water-Cooled Reactors and Further Improvement of Reactors of This Type."

Multilateral cooperation is being enacted also in the area of the development of high-power fast reactors.

All this will make it possible to develop on a unified equipment base nuclear power plant industry production capacities and to ensure speedier development of nuclear power for CEMA member countries.

Of course, the combined measures are exceptional both with respect to the amount of work to be done and the pace for accomplishing it. In this connection the power plant industry is faced with important goals for increasing the output of equipment for high-capacity nuclear power units.

The realization of these goals must be provided for primarily by the creation of modern equipment designs and by the use of an advanced manufacturing technology.

The creation of nuclear power equipment is a complex science and engineering problem requiring the broad participation of scientists and specialists in many areas of modern science and engineering. In designing and making equipment for nuclear power plants it is necessary to satisfy high requirements with respect to safety, reliability and economy. Therefore, the guiding principle must be cooperation among designers and industrial engineers beginning at the very early stages of development of design and production process documentation.

In order most effectively to embody in new designs the achievements of science and engineering, under today's conditions it is impossible to manage without large-scale scientific research development. The creation in the USSR of the first model of a nuclear power plant with a type VVER-1000 reactor was an example. In designing and mastering the production of the equipment for this large-capacity nuclear power plant a cycle of many years of research was carried out with regard to investigating and mastering the production of new sorts of steel, and the development of high-efficiency technological processes and production equipment and methods and facilities for controlling the quality of stock and products.

Of course, new equipment can be mastered by industry more quickly the more adaptable it is to streamlined production, i.e., the more fully the requirements and capabilities of modern production are taken into account in creating it.

The fact is that the conditions for the use of nuclear power equipment and the unique overall dimensions and complexity of structures require materials with a favorable combination of strength and ductile properties and with high resistance to the specific effect of working media and which are adaptable to streamlined production methods at all production stages. In evaluating adaptability to streamlined production methods, of major significance are such characteristics as, for example, the sensitivity of the steel's properties to gas saturation and contamination with nonmetallic inclusions and impurities, and its tendency toward chemical inhomogeneity and toward the formation of shrinkage cracks.

It is necessary also to take into account the fact that for making (forging) stock for reactor shell parts ingots of maximum size are used weighing up to 400 to 500 tons. It is clear how important the problem of guaranteeing the quality of the metal is here. Studying ingots and forgings of this type is very expensive and requires a lot of time. Mathematical modeling of the processes taking place in solidification of the metal helps to solve this problem. It makes it possible to estimate the influence of various technological factors, to select the optimum design of an ingot, to predict its physical and chemical homogeneity and in the final analysis to control the quality of the metal.

A low tendency toward formation of cracks, temper resistance and repairability are important in welding and surfacing.

Know-how gained by machine builders has demonstrated that in the development of new construction materials the combined approach to evaluating their adaptability to streamlined production is the decisive machine building principle making possible the fullest utilization of the capabilities of materials and the optimum degree of satisfaction of the requirements of product engineers in various fields of specialization.

This example is representative. Existing production capabilities and railway transportation conditions have imposed certain limitations on the overall dimensions and weight of the shell of a type VVER-1000 reactor. In order to make possible the required capacity with the permissible overall dimensions and weight of the reactor, for its manufacture a steel was required with a strength level greater than those known in world practice. Furthermore, it was necessary to satisfy in the best manner the diverse requirements of modern technology at all production process stages, including melting, forging, welding and heat treating and machining. This became possible as the result of a thorough test under laboratory and production conditions of the technological properties of the new steel, which was done together by our scientific production association, which has a complex of research laboratories and a lot of work experience in all key technological processes of machine building, and by other scientific research organizations and enterprises which manufacture stock and equipment.

These preliminary remarks serve as an introduction to the range of nuclear power industry technological problems and underline their importance for mastering the production of nuclear power plant equipment.

Let us now discuss the status of the solution of major problems and some objectives in this area.

#### Materials Technology

The adaptability of steel to streamlined production is made possible primarily on account of intelligent alloying, i.e., selection of the optimum chemical composition. An in-depth study was made of the influence of alloying on the properties of steel in investigating construction materials for the most important equipment. The interrelationship was established between radiation resistance and chemical composition and metallurgical and technological factors. The content of alloying elements and impurities in types of steel was optimized on this basis.

It is also known that the properties of steel are determined to a great extent by the technological capabilities of metallurgical production. Development of the electric furnace steel melting process, the increase in the unit capacity of a melting unit and the use of out-of-furnace refining represent key trends in improvement of the steel melting base of the power plant industry. In this way it proved to be possible to achieve considerable purity of the metal with respect to gas and nonmetallic inclusion content and to make possible the highest stability of properties.

In the production of nuclear power equipment a great amount of testing of the mechanical properties of materials is performed, including shortterm, longterm and fatigue tests, and tests at room and elevated temperatures, under conditions of the effect of working media, etc. High requirements are imposed on the accuracy of determining strength characteristics and methods of evaluating them are being improved constantly. Not the slightest miscalculation can be permitted in determining the strength and durability of structures. The possibility of accidents resulting from failure of structures must be eliminated.

Therefore, one of the leading trends has been the development of measures eliminating unexpected failure under any conditions of use, which requires taking into account the influence on the serviceability of structures of the state of the material and of technological defects (metallurgical, welding, etc.), since it is always necessary to take into account the possibility of their presence in a material. New ideas regarding failure as a process associated with crack growth have drawn attention to studying the qualitative and quantitative characteristics of resistance to crack propagation. Accumulation and systematization of these data coupled with design, technological and use factors are conducive to the intelligent design of structures which are adaptable to streamlined production and have guaranteed serviceability over their entire service life.

Heat treating problems are associated with the unique dimensions of nuclear power equipment semifinished products. The unusual conditions for mechanically shaping large forgings--the great number of smith forging operations with intermediate preheating and automatic and electroslag welding of semifinished products of great thickness--hamper obtainment of high and uniform properties for steel.

For the purpose of enabling a favorable combination of physicomachanical and technological properties for semifinished products, determination of the interrelationship of the state of types of steel and the conditions for their heating and cooling has been of great importance. This has made it possible to determine the hardenability characteristics of steel and to substantiate the speed conditions for heat treating large forgings and castings. Studying the nature and kinetics of structural transformations in steel has made it possible to choose the temperature-time parameters for heating and cooling (tempering) large welded semifinished pieces.

In solving the problem of improving the productivity, economic efficiency and quality of heating semifinished items during mechanical working and heat treating, methods have been developed for heating with a minimum temperature difference in the working space of furnaces.

The shells of reactors and the rotors of turbines and generators are made from ingots of maximum high weight. Materiologists and product engineers are solving the problem of mastering the production of forgings from ingots weighing 300 tons, and in the immediate future up to 500 tons, which will make it possible to make unit-forged semifinished pieces for rotors of high-speed turbines for 1000-MW nuclear power units, and to reduce the number of welds in making nuclear reactor shells, steam generators and other vessels operating under pressure.

Prospects here involve automation of technological processes of mechanical working. Finding optimum solutions requires detailed development of technological processes, finding their most important physical mechanisms, constructing on this basis a mathematical model of the process and selecting the strategy for controlling automated systems. An automated system for preparing control programs has been created for forging complexes, which solves the problems of calculating conditions for shaping forgings, minimizing the process time and number of operations, and taking into account technological limitations upon condition of producing forgings of the required quality.

The use of advanced technological processes represents a considerable potential for shortening the production cycle, reducing the labor intensiveness of manufacture and improving the quality of nuclear power equipment.

For example, in worldwide practice in shells for the reactor, steam generator and other equipment of nuclear power plants connecting pieces for connecting to pipe lines are produced by welding an individually made connecting piece to the shell.

A technological process for making shells with connecting pieces made by forging which form a single whole with the shell is used in the USSR. The possibility is provided of producing the connecting piece height and wall thickness required for the shell's strength specifications and for the process of subsequent welding on of pipes.

It is impossible not to mention the problems of developing and mastering the production of power equipment of various sizes and for various purposes (regulating, shutoff and protective). Scientific and engineering cooperation within the CEMA framework is also being carried out in this area. There are a number of examples of the successful solution of individual production problems in the USSR.

For example, a technological process has been developed and mastered in production for making unit-forged thin-walled T-joints and sharply bending elbows. It is two to three times more productive than known processes for forging large T-joints and elbows.

A production process for making forged-and-welded shells for large power equipment has made high technical and economic efficiency possible. Higher quality of shells is made possible and the consumption of metal is reduced because of a combination of sheet forging and die forging methods.

In the production of nuclear power equipment a considerable role belongs to processes of welding and corrosion-proofing surfacing. The trend of using enhanced-strength structural steel has required the investigation of welding materials and a welding and surfacing technology enabling, in addition to the required level of mechanical properties, the high resistance of welded joints to the formation of cracks in welding and heat treating.

Extensive studies made in recent years of the weldability of sorts of steel and the crack resistance of their joints formed the basis of the development of welding and surfacing material compositions and of recommendations for welding and

heat treating operations. For the purpose of predicting the serviceability of welded joints under conditions of use, a considerable amount of tests of static and fatigue strength have been made, and a determination has been made of the influence of prolonged heating, strain ageing and the effect of corrosive and active media.

The problem of ensuring the radiation resistance of welded joints must be singled out especially. Of course, in the process of use the shell of the reactor and other crucial elements of nuclear power plant structures are subjected to prolonged intense radioactive exposure. This over the course of time causes unfavorable changes in the performance properties of construction materials. Finding ways of reducing their radiation damage is one of the most important objectives of materialogists and product engineers. Extensive studies in many directions have been made for the purpose of solving this problem, including the fact that in recent years a study has been made of the influence of impurities of gold, phosphorus, copper and other chemical elements on the tendency toward radiation embrittlement. The results arrived at have made it possible to refine the chemical composition of welding and surfacing materials in arranging for their industrial application.

Easily separable fluxes adaptable to streamlined production have been created which make possible, because of their good welding and technological properties, welded joints of high quality.

The technology of welding and surfacing processes is being improved along the line of increasing the productivity of working processes, economic efficiency and the quality of welded products. On account of mastery of the process of welding thin-walled sections with a narrow separation, the productivity of welding operations has increased twofold and the consumption of welding materials has been reduced. Automation of this process has considerably improved working conditions for workers.

Improvement of the quality of surfacing of reactor and steam generator shells has made it possible to change to 2-layer automatic surfacing using flux and flat-conductor electrodes instead of 3- and 4-layer, which has considerably reduced the labor intensiveness of making shells.

A modern production process must be based on modern production process equipment. Along this line developments are actively under way on many types of equipment, including welding equipment using electron beam, plasma-vacuum, laser, pulsed and other promising processes. The level of mechanization and automation of processes is increasing steadily. For the purpose of illustration it is possible to name the unique "welding center" equipment complex for automated welding of steam generator shells, outfitted with equipment for welding, preheating and machining. A high-output process and equipment have been developed for automatic surfacing of equipment parts, using flat-conductor electrodes and alloying fused ceramic fluxes.

It is clear that the solution of the complex problems relating to ensuring high serviceability of nuclear power equipment must be based on evaluating the quality of the metal and the technical condition of structures by means of nondestructive methods.

The quality of metals, semifinished products and welded joints is checked repeatedly in the production of equipment. The labor intensiveness of testing operations in the production of some units and parts reaches 20 to 30 percent of the total labor intensiveness. Therefore, in addition to improvement and development of new methods and facilities for nondestructive testing, much attention should be paid to automation of testing.

Development work along this line is being carried out extensively in the USSR. Stationary benches have been created for high-productivity automated ultrasonic, magnetic powder and capillary inspection of welded joints of high-pressure vessels with a wall thickness greater than 250 mm. Equipment has been developed for ultrasonic and electromagnetic inspection combined with machining, which shortens the length of the production cycle.

For the purpose of optimizing planning and design solutions for testing equipment and facilities, theoretical and experimental studies are being made of the physical fundamentals of the detectability of flaws in metal and of criteria for their proneness to accident along with studies along the line of creating a technical specification base for inspection.

Experience has demonstrated that not every flaw in metal inevitably results in a drastic reduction of the serviceability of a structure. As a rule the location of the flaw in the structure, its configuration, size and position relative to effective loads are of no slight importance.

Therefore, the problem is one of determining the form, size and orientation of production process flaws in metals. A promising direction for solving this problem has been the development of the spectral method, based on the established inter-relationship between the spectrum of ultrasound signals and the configuration and dimensions of flaws. Development of acoustic emission methods and equipment for inspection of semifinished items and products is under way.

This work has the purpose of ensuring high quality of the manufacture of nuclear power plant equipment and of obtaining reliable information on the technical condition of structures for the purpose of predicting serviceability.

The examples discussed do not exhaust the range of problems facing power plant builders. Machine building technology is exceptionally diversified. In making parts and units of machines a great number of technological operations are performed which exert a considerably mutual influence. Therefore, a single-minded search is under way for the mechanisms of machine building production processes and for their interinfluence under production conditions. The efforts of physicists, chemists, mechanical engineers, materiologists and product engineers are being concentrated on solving these problems. Along this line international scientific and engineering cooperation is also being carried out within the framework of the agreements and combined programs of CEMA.

Thorough specialization and cooperation in production must be based on unified norms and standards enabling unified requirements with respect to reliability and quality. Licensing and contract agreements made by many scientific research and

planning and design organizations and industrial enterprises of CEMA member countries are responding to this objective.

A good example of cooperation is represented by the combined scientific and engineering developments of the Scientific Production Association for Machinebuilding Technology and organizations and enterprises of the CSSR, i.e., the State Scientific Research Institute of Materials (SVUM) and State Scientific Research Institute of Machinebuilding (SVUSS) (Prague) of the "Shkoda" [Škoda] Association.

These are aimed chiefly at solving specific production problems and contain definite stages in the work and the obligations of the parties.

The technical and economic results achieved testify to the fact that latent in cooperation of this sort is a great potential for the more rapid introduction of the achievements of science and engineering into production and for speeding, on this basis, progress in the nuclear power industry of CEMA member countries.

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## ELECTRIC POWER

### KHMEL'NITSKAYA AES, KHMEL'NITSKAYA AES - RZESZÓW LEP CONSTRUCTION

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 6, Jun 82  
pp 60-62

[Article by Aleksandr Kovalkin, executive secretary, Soviet section, CEMA Standing Committee on Cooperation in the Field of Electric Power]

[Text] Strengthening of the fuel and energy base is the most important condition for further stable economic development of CEMA member countries.

The socialist countries have been solving the fuel and energy problem by taking into account national and international interests within the framework of an international integration mechanism of a new type, such as CEMA is.

The CEMA Standing Committee on Cooperation in the Field of Electric Power in keeping with the combined program has developed a general scheme for future development of the united electric power systems of CEMA member countries to 1990. It has designated ways to achieve a balanced fuel and energy balance and the direction of development of the unified power systems (OES's) of CEMA member countries as well as of the development of the power industry in each individual country.

Provision for the economically substantiated demands of CEMA member countries for electric power in the long term is foreseen chiefly as the result of an increase in the internal production of electric power by means of the maximum involvement of available reserves of fuel and energy resources, leading development of nuclear power and an increase in the supply of electric power to one another based on construction of power facilities by the joint efforts of interested countries.

In keeping with the general agreement regarding cooperation in future development of the united electric power systems of CEMA member countries for the period to 1990, the plan is to bring the installed power at nuclear power plants to 37 million kilowatts in the European socialist countries. In addition, by combined efforts two nuclear power plants with a total capacity of 8 million kW, half of whose production of electric power will be transmitted through the United Power System to CEMA member countries, will be constructed in the territory of the Soviet Union. This will make it possible to save organic fuel annually to the tune of about 70 million tons of equivalent fuel.

The first such nuclear power facilities will be the Khmel'nitskaya AES, being built by the combined efforts of the Hungarian People's Republic, Polish People's Republic, USSR and CSSR, and the Khmel'nitskaya AES (USSR) - Rzeszów (Polish People's Republic) 750-kV electrotransmission line being erected with the participation of the Hungarian People's Republic, GDR, Polish People's Republic, USSR and CSSR. According to the agreement, the amount of electric power which each country participating in creation of this nuclear power plant will receive will be directly proportional to their contribution to the construction.

The Soviet side is providing the construction project with engineering and estimating and financing documentation, is allocating the physical and financial resources required for constructing the nuclear power plant, is carrying out construction and erection work at facilities of the site of the Khmel'nitskaya AES, and after the power blocks are put into service will assume concern for the power plant's operation and for furnishing it with nuclear fuel.

The construction site for the Khmel'nitskaya AES is located in Khmel'nitskaya Oblast of the Ukrainian SSR on the left bank of the Goryn' River. Railway approach lines, motor vehicle roads, a 110-kV electrotransmission line, a 110/35/10-kV substation, a concrete-mortar unit and motor vehicle transport equipment shops have already been built and put into service and construction of the concrete plant is being completed. Six 50-apartment dwellings, 3 hostels and an 89-apartment dwelling have been put into service. At the present time the main work is being done on concreting the foundation for the reactor of the first block and on developing a foundation pit beneath the engine room and special building.

The Hungarian, Polish and Czechoslovak sides, to the extent of their proportional participation, are supplying for erection of the Khmel'nitskaya AES materials, machinery, equipment and consumer goods. For example, the Hungarian People's Republic is furnishing communications equipment and measuring instruments, equipment for applying paint, buses, construction machinery and gear, materials, some kinds of rolled products, resins, cable and cement-and-chip slabs; the CSSR is supplying production equipment, transport vehicles, including heavy-duty "Tatra" trucks, machine tools and press forging equipment, pipes, stainless steel, paints, facing tiles and electric lighting fixtures. Electric engineering equipment, testing and measuring instruments, tools and construction equipment (bulldozers, trailers, erection rigs, cranes and loaders) are being supplied by the Polish People's Republic.

Polish construction and erection organizations are making a considerable contribution to construction of the Khmel'nitskaya AES. The teams of these organizations have been arriving in the USSR outfitted with skilled workers and specialists and furnished with the basic construction equipment and transport vehicles required for performing the entire combination of building and erection work. At the Khmel'nitskaya AES Polish workers have constructed the pumping plant, decontamination facilities, boiler house and fire station and are building mains services and roads and are beginning construction of the special building. The projects for public and social and cultural purposes are taking a great deal of work; these include hostels, hotels, multistory dwellings, a kindergarten and store.

By virtue of their shared participation in construction of the Khmel'nitskaya AES, Polish construction organizations are doing some work at the Kursk and Smolensk AES's, where a diesel-generator, nitrogen-and-oxygen and compressor station, 750-kV outdoor switchgear, a public administration building, a graphite storehouse and a greenhouse center have been constructed by their manpower. Work is under way on construction of a water intake duct, service mains, roads, etc. Polish workers have already begun work on the main building at the Smolensk AES.

Just as at the Khmel'nitskaya AES, projects for public and social and cultural purposes are taking a great amount of work; these include a shopping center, sports complex, hotel, a residential building in Kurchatov (Kursk AES), a school, store, medical complex, and a large-scale bakery in Desnogorsk (Smolensk AES).

The general contractor for the construction project--the Soyuzatomenergostroy All-Union Association of the USSR Ministry of Power and Electrification--is providing Polish erection organizations with housing to accommodate Polish specialists, is providing them with service rooms and is assigning, in keeping with the construction schedule, all basic materials, articles, steel structures, prefabricated construction elements and production equipment. The work is being done according to Soviet production forms and records.

In return for deliveries of merchandise to the USSR from the Hungarian People's Republic, Polish People's Republic and the CSSR, as well as for the rendering of services in the performance of construction and erection work at nuclear power plants, the Soviet side, after the entry into service of the first block of the Khmel'nitskaya AES and the construction of the appropriate electrotransmission lines, will guarantee for a period of 20 years supplies of electric power from the USSR power system to the power systems of these countries, whose annual amounts will equal by 1990 2.4 billion kWh (with a capacity of 400,000 kW) for the Hungarian People's Republic, 6 billion kWh (with a capacity of 1 million kW) for the Polish People's Republic and 3.6 billion kWh (with a capacity of 600,000 kW) for the CSSR.

At the Khmel'nitskaya AES under construction, which will provide electric power not only for the USSR, but also for power systems of CEMA member countries, four blocks with reactors of the VVER-1000 type with a capacity of 1 million kW each will be installed.

At the present time nuclear power plants with type VVER-440 reactors with a capacity of 440,000 kW are being built in CEMA member countries and these have demonstrated sufficiently reliable, safe and economical operation under quite varied climate and natural conditions. But the technical and economic indicators for nuclear power must be improved by simplification of the elements of a nuclear power plant design while maintaining all safety requirements, reducing the input of materials, improving instruments and systems for checking the operation of equipment, and raising the level of automation. The type VVER-1000 water-cooled reactor with unit electric power of 1 million kW represents precisely the next stage in the development of nuclear power.

The leading first reactor of this type was assembled and put into service in the USSR in 1980 at the Novovoronezhskiy Nuclear Power Plant. Beginning in 1985

reactors of the VVER-1000 type will be installed in all nuclear power plants built in CEMA member countries.

But it is not to be forgotten that nuclear power is potentially the most dangerous form of energy of all those known to mankind. This makes it necessary for everyone--from planners and designers of nuclear power plants and manufacturers of equipment for them to builders, erectors and operating personnel--to take every necessary technical measure to prevent the possibility of accidental excursions and radioactive contamination.

The specific nature of the problem of nuclear power plant safety even at the very beginning of the design stage required, as compared with design solutions for ordinary thermal power stations, a quantitatively and qualitatively new approach to the design of safe and reliable equipment systems. Valuable know-how has already been gained in this area and it has been embodied to the full extent in the project for the Khmel'nitskaya AES.

The strict requirements for safety and reliability of the operation of a nuclear power plant of course result in making the project more expensive. But the cost of environmental protection in nuclear power gives a considerably greater return than in traditional thermal power. Nuclear power plants do not need oxygen and do not foul the air basin with sulfur compounds and various combustion products which are ejected in large quantity by power plants operating on organic fuel. Therefore, the development of nuclear power is justified not only out of economic, but also out of ecological considerations.

After the Khmel'nitskaya AES reaches full capacity, the supply of electric power from the USSR to sister countries will double. For the purpose of transmitting electric power from the Khmel'nitskaya AES to interested countries, as well as for purposes of realizing an additional savings from combining the load curves and power reserves among the power systems of participating countries, a 750-kV Khmel'nitskaya AES (USSR) - Rzeszów (Polish People's Republic) electrotransmission line will be constructed by the combined efforts of the Hungarian People's Republic, GDR, Polish People's Republic, USSR and CSSR. By means of this electrotransmission line scheduled deliveries of electric power will be made from the USSR to the Polish People's Republic, as well as to the Hungarian People's Republic and CSSR by means of routing through the electric power systems of the Polish People's Republic and then of the CSSR. Its length will equal 377 km, including 260 km in the territory of the USSR and 117 km in the territory of the Polish People's Republic.

The detailed design for the 750-kV electrotransmission line is being developed at the present time and preparatory work has been begun on the construction of substations along the route of the electrotransmission line. The basic engineering decisions for electrotransmission facilities have been made by the Soviet side and have been agreed upon with the interested countries and the general section of the detailed design has been submitted for approval.

The importance of these facilities for the economies of the participating countries is difficult to overestimate. In addition to the economic advantage, also important are the technical advantages associated with the mastery of 750-kV voltage,

further improvement of the reliability of the power supply to consumers and parallel operation of the OES's of CEMA member countries and the YeES [Unified Power System] of the USSR.

With the creation of strong electrical connections between power systems the conditions are created for installing in small power systems the most modern power equipment of nuclear power plants with blocks with a capacity of 1 million kW.

This method of "ringing" large nuclear power plants with 750-kV lines has been tried in the Soviet Union. It has demonstrated the effectiveness of its application in the large power systems of the Soviet Union. It will be of even greater value for the relatively small systems of European CEMA member countries.

Thus, the ways, designated by CEMA member countries in the longterm special-purpose program for cooperation in the area of energy, fuel and raw materials, of further expanding cooperation in a leading sector of the socialist economy--electric power--have been successfully put into practice. The Khmel'nitskaya AES is part of this program.

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## ELECTRIC POWER

### ABAKAN THERMOELECTRIC PLANT CONSTRUCTION CONTINUATION IN LIMBO

Moscow STROITEL'NAYA GAZETA in Russian 7 May 82 p 2

[Article by P. Lyakutin, STROITEL'NAYA GAZETA non-staff correspondent, Krasnoyarskiy Kray: "Who Needs a Thermoelectric Plant?"]

[Text] The Abakan Thermoelectric Plant is the first in the Khakas Autonomous Oblast. Having begun its construction, the personnel of the then still small-scale Abakanenergopromstroy [expansion unknown] and their subcontractors had with a short deadline to enlarge their teams, to find and train on the job hundreds of workers and to master the most complicated process for assembly of equipment. And though not at once, with a great amount of work, builders and erectors coped with these problems. So that at the beginning of March, on the day of startup of the first unit, they rightfully felt cheery.

A meeting was organized on the occasion of the joyful event. With an orchestra, slides, congratulations and speeches. Almost all the speakers after the ceremonial phrases celebrating the event said that the startup of the first power unit was only the beginning. Now it is necessary to put the next capacities into service in a very short time. They expected the same from B. Yegorov, the general director of the Abakanvagonmash [expansion unknown] Production Association, the main customer. (Just the other day V. Yegorov was transferred to another post.) But he did not say a word about continuation of the construction. As though he had completely forgotten that the project and plan call for the assembly of two more power generating units in the thermoelectric plant building already erected.

In order to explain the sudden onslaught of muteness on the part of the client, it is necessary to know the, although not very long, but already fairly involved, story of the construction project.

According to the specification, the thermoelectric plant is intended for supplying power to that giant of heavy industry, under construction and already partly in operation, the Abakanvagonmash Association. Surpluses of heat and electric power will serve the needs of other enterprises of the Abakan industrial center and the residential districts of the Khakas Oblast center. More than 100 small boiler houses are in operation here today. Taken together, they are not able to satisfy Abakan's demand for heat and on the other hand they are good at emitting clouds of smoke into the atmosphere. To give the city a permanent powerful source of energy while at the same time keeping the environment untouched--what can be nobler

than this objective? And all the same the plan is having its birth pangs.

Let us begin if only from the fact that the present deadline for startup of the first generating unit is the fourth in a row. The first was broken by the builders--the general contractor was not able to recruit the manpower. The second was postponed since the Ministry of Heavy Machine Building, which Abakanvagonmash comes under, delayed financing of the project. The third was not kept because the same Ministry of Heavy Machine Building did not deliver the equipment in time. Not all of it, you understand, but did not equip something with respect to small items. Until the small items were obtained--and almost a year went by for this--the builders, not wishing to have nothing to do, became familiar with all the equipment allotted for erection of the thermoelectric plant. Even at the very last, prestartup stage things went so badly that it seemed as though someone out of the whole multitude was holding the construction project back. But who?

"The client, of course," unanimously say the builders and personnel of the oblast stroybank [bank for financing of capital investments].

But let us not be too trustful; let us turn to the facts.

Last year, having found out that the construction of the first power generating unit was being delayed because of a lack of equipment, I tried to find out at Abakanvagonmash's capital construction administration precisely what was lacking for the startup. I prepared a notebook in order to write down poorly understood terms and indexes and numbers of orders. But for an answer I heard:

"Like in the turbine one pipe is missing. A long shiny one. Devil knows where it disappeared to! Perhaps it was cut into pieces earlier and it was fitted somewhere?"

No wonder that with such "competent" handling of equipment fastening parts for the setting of the boiler were lost, the turbogenerator set was not completely furnished and reagents for the chemical water purification plant were missing.

"Well, you know, we are not power engineers so that we understand what is for what here," one of the workers of Abakanvagonmash told me, and added in a fit of temper, "They laid this thermoelectric plant on us like dumbbells on our legs!"

And then, wishing to put myself in the client's situation, I picked up a calculator and made a discovery. The thermoelectric plant for Abakanvagonmash is really like a set of dumbbells. Consider. The capacity of the electric generator for the first generating unit which has been started up is 60 MW. And today the association needs three times less! It is approximately the same relationship between the generation of and demand for thermal energy. When just the first phase of the thermoelectric plant as a whole goes into service it will produce almost 11 times more energy than the client needs! Even with the startup of the association's new capacities it will be far from a major consumer of the energy.

So it turns out that it is economically disadvantageous for the Abakan car builders to be a customer of the plant. Therefore, they are not taking pains to continue its construction.

So, is it worthwhile reproaching the present proprietors of the thermoelectric plant for this? It probably is worthwhile all the same. For if the motives for the client's behavior are now clear, then their very actions look unimpressive. For example, about a year ago the general director of Abakanvagonmash, B. Yegorov, stated publicly:

"To say that we are not interested in constructing the thermoelectric plant is not legitimate. The association is fulfilling its obligations with regard to the construction project. Our shortcomings are no more than the ordinary blunders of a client."

But approximately at the same time Deputy Minister of Heavy Machine Building V. Nalivayko was holding a meeting, the participants in which made the following decision: to cancel contracts for delivery of equipment for the Abakan Thermoelectric Plant. To silently sell even what was already in warehouses for the second and third power generating units. Under the specious excuse of releasing uninstalled equipment from above-norm reserves.

What we have here is an illegal play, as they say. And Mintyazhmash [Ministry of Heavy Machine Building] is playing it only because it does not have the courage to admit that they made a blunder, it is said, at the time when they accepted the obligations of the client for the thermoelectric plant. If they had not done this the fate of the thermoelectric plant would have been different.

The designers, you know, did not accidentally put in excess capacities. Residents of Abakan and small enterprises are already now without them, as without hands. Another point is that using such a thermoelectric plant as the Abakan was designed to be is a matter not for machine builders but for the USSR Ministry of Power and Electrification. It, then, should have been the client. But the USSR Ministry of Heavy Construction was not able to look into the situation (or did not want to; a heavy portion of the capital allotted for the thermoelectric plant went for the needs of car builders), and the USSR Gosplan did not speak its decisive word; it "let the chance slip by," to put it mildly.

Economists say that an invested ruble must work. Neither many nor few of these rubles--almost 35 million--have been invested in the thermoelectric plant already now. But there has been no return from them in full measure.

Moreover, profits and losses must be counted not only in rubles.

For example, up to now the heat supply for a considerable portion of the oblast center is functioning according to a time schedule, so to speak, because of the peak boiler house of the same Abakanvagonmash Association. In the new heating season these functions will be assumed by the thermoelectric plant's service. But how it will cope with them nobody will say: Further construction of the plant has been practically canned and one power generating unit even theoretically cannot operate steadily.



That, as a matter of fact, is all about the unenviable fate of the Abakan Thermoelectric Plant. It has a sort of owner but it does not need it.

Perhaps the USSR Ministry of Power and Electrification will embrace Cinderella with the permission of Gosplan. And if it also turns her down?

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## ELECTRIC POWER

### ATOMMASH PROJECT DELAYED BY METALWORK SHORTAGE

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 17 Jun 82 p 2

[Article by V. Lifanov, SOTSIALISTICHESKAYA INDUSTRIYA special correspondent:  
"They Signed and Forgot"]

[Text] This year the Vologdonskenergostroy Trust requires more than 10,000 tons of various types of metalwork mainly for construction of the Atomash and Rostov Nuclear Power Plant projects. According to the schedule, 4756 tons were already to have been received. But the suppliers treated the fulfillment of contract obligations without the proper sense of responsibility and unloaded in Volgodonsk barely more than half of what was designated.

We immediately note that they are all part of the same ministry as Volgodonskenergostroy, but for some reason display an attitude of being clearly unrelated to it. The Energostal'konstruktsiya Trust, for example, succeeded in borrowing almost 800 tons of its products and Glavenergostroymekhanizatsiya [USSR Ministry of Power and Electrification Central Administration for Mechanization of Construction] more than 800 tons. Two of their enterprises--the North Caucasus Steel Structures Plant and the Zuyevka Power Machinery Plant--especially "excelled."

The Chaykovskiy Machinery Repair Plant of Glavzavodspetsstroy [expansion unknown] did not deliver not very large but important structures to the tune of 100 tons, and Kamgesenergostroy [expansion unknown] 89 tons, Glavteploenergomontazh [Central Administration for Assembly of Thermal Power Equipment for Electric Power Plants] 88 tons and Glavenergostroyprom [USSR Ministry of Electric Power Station Construction Central Administration for Enterprises for Production of Building Structures and Materials], 120 tons.

Letters and applications to the above-indicated addresses proved to have little effect. Almost all metalwork suppliers referred to the lack of metal as though this releases them of responsibility to the customer.

Enterprises which manufacture precast reinforced concrete, which are also part of the USSR Ministry of Power and Electrification and, more specifically, of Glavenergostroyprom, which is subordinate to this ministry, are behaving approximately the same way.

Having signed in Volgodonsk an agreement regarding socialist competition within the "working relay race" framework, many obviously forgot their obligations although the signing took place quite recently. The Donbassenergostroyindustriya Trust of the 12,700 cubic meters due for delivery in January-May borrowed 2000, and the Administration for Power Production Enterprises Under Construction (USEPP) about 4000 out of 17,000. And as a whole enterprises of Glavenergostroyprom did not deliver to Volgodonsk in time more than 6000 cubic meters of precast reinforced concrete.

The lag is progressing with a buildup and if the proper measures are not taken Volgodonsk builders will turn out to be in an even more difficult situation than they are now.

[Editorial comment]

[Text] In No 25 (181), already published, of the newspaper SOTSIALISTICHESKAYA INDUSTRIYA, in the "At Atommash" section, a situation review titled "When Will an Abrupt Change Begin?" was printed, in which the main reasons for the lag among builders were named: late formation of the startup complex, non-outfitting of subdivisions with personnel, serious shortcomings in organization of construction production and supplies of materials and equipment, and low labor productivity.

The newspaper reports that the oblast headquarters of the construction project has assigned the Volgodonskenergostroy Trust the task of overcoming the lag at sites of the startup complex within a condensed period and then of carrying out their construction in strict agreement with the schedules established. Every opportunity exists for this.

In this issue an article is published by the secretary of the party committee for production of the first Atommash building, V. Bessarov, "Choice Turned Out to Be Correct." Atommash Planer A. Verkhovov talks about the chairman of the department crew council, B. Yevlanov, in the sketch "By the Leader's Rights."

V. Navozov's correspondence is devoted to Political Information Officer S. Strakhov and to his advanced know-how in educational work. A photo essay by O. Razhevaya and A. Mileykovskiy, "Guarding Health," is timed for Medical Personnel Day.

Various kinds of information are presented. Responses to the newspaper's protests are published.

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## FUELS

### HIGH LEVEL OFFICIALS DISCUSS GAS INDUSTRY'S CURRENT STATE, PROSPECTS

Moscow PLANOVYE KHOZYAYSTVO in Russian No 6, Jun 82 pp 14-23

[Roundtable discussion with First Deputy Minister of Construction of Petroleum and Gas Industry Enterprises and Lenin Prizewinner Yu. P. Batalin; Deputy Chairman of Gosexpertiza of USSR Gosplan, Doctor of Engineering Sciences and State Prizewinner Yu. I. Bokserman; and First Deputy Minister of Gas Industry and State Prizewinner G. D. Margulov, led by L. A. Voznesenskiy: "The Gas Industry: Results and Prospects"]

[Text] During the years of building socialism in the USSR, with the efforts of the people of the whole country, a high-capacity gas industry has been created that has reached a high scale of development during recent five-year plans. The country's Unified Gas-Supply System is in operation. Problems of further developing the gas industry, especially problems of assimilating the West Siberian Oil and Gas Complex, were the topic of the conversation that is published here, which was participated in by First Deputy Minister of Construction of Petroleum and Gas Industry Enterprises and Lenin Prizewinner Yu. P. Batalin; Deputy Chairman of Gosexpertiza of USSR Gosplan, Doctor of Engineering Sciences and State Prizewinner Yu. I. Bokserman; and First Deputy Minister of Gas Industry and State Prizewinner G. D. Margulov. The conversation was conducted by L. A. Voznesenskiy.

L. A. Voznesenskiy: Today there is hardly a branch of the national economy that does not in one way or another depend upon development of the gas industry and that does not use the products of its output. It is known, for example, that right now, we use natural gas to obtain more than nine-tenths of our pig iron, steel and mineral fertilizer, and that about 200 million people, that is, almost three-fourths of the country's population, are using gas at home.

I would like to start our conversation with the question of the pace and scale of development of the gas industry, upon which our country's scientific and technical progress depends to an ever-increasing extent. I address this question to Yu. I. Bokserman--USSR Gosplan chairman.

Yu. I. Bokserman: The gas industry has no peer in pace and scale of development. Before the war, in 1940 we recovered only 3 billion m<sup>3</sup> of gas in the country, while right now we recover that much in 2 days. Gas reserves prior to the war

comprised about 15 billion m<sup>3</sup>, but today that would not suffice to support the annual demand of Moscow alone. And at that time we were lagging America 100-fold in gas-recovery level.

At the start of the war our geologists found gas close to Saratov, and, although the war still had not ended, the State Defense Committee made a decision to build our country's first gas pipeline, from Saratov to Moscow. Its length was 800 km. This was a difficult time, there was no experience, no machinery and no mechanisms, and the principal work basically was performed manually. But the gas pipeline was built, and in the summer of 1946 Saratov gas arrived in Moscow. In the postwar years a new branch of the economy--the gas industry--was established in a short time by the efforts of the party and the government and by the labor of the Soviet people.

The establishment and development of the domestic gas industry are a bright example of the friendship of the peoples of the Soviet Union. After erection of the gas industry's firstling--the Saratov-Moscow gas pipeline--builders' collectives were sent to the Ukraine to help build a gas pipeline from the Carpathians to Kiev and Moscow, and they were also sent to Estonia--to build a high-capacity shale-processing combine at Kokhtla-Yarve and a gas pipeline from there to Leningrad. The Ukraine now has a developed gas industry, and Estonia extracts gas and liquid fuel from shale.

Then a high-capacity gasser at Gazli encouraged geologists' searches, and the Uzbek SSR became a major gas-recovering region, supplying gas to the Urals, the country's central regions, Kirgizia, Tajikistan and Kazakhstan. Streams of gas poured into this system from Turkmenia. And, finally, discovery of the unique gas fields in West Siberia was a decisive factor in forming the Unified Gas-Supply System, which now provides gas to all the Union republics and to practically all regions. The assimilation of Siberia's fuel-and-power and raw-material resources is one of the major nationwide economic tasks. Workers of all Union republics are making their contribution to solving it. "This," as the CPSU Central Committee decree about the 60th anniversary of the forming of the Union of Soviet Socialist Republics noted, "is a noteworthy social and socio-political phenomenon of our day."

We are able to plan gas recovery for the long term, viewing it as a stable and reliable component of the long-term energy program. USSR Gosplan, GKNT [State Committee for Science and Technology], the USSR Academy of Sciences and the ministries are now working on this program.

The achievements of recent years and the high pace and scale of gas-industry development will enable us to outdistance the United States of America in level of gas recovery and firmly take first place in the world in the next 1½ to 2 years.

The West Siberian Oil and Gas Complex has an important place in all the bold and majestic plans for further accelerated gas industry development. With the establishment of a gas recovery level of 630 billion m<sup>3</sup> for the country in 1985, fields in the northern regions of Tyumenskaya Oblast will recover a substantial portion of the nationwide volume. Six trunk gas pipelines from this region are to be erected during the 11th Five-Year Plan. Two of them have been built, and the construction of a third arterial is being completed.

The press, including PLANOVOYE KHOZYAYSTVO, has often stressed the need for an integrated approach to solving the complicated problems of developing all branches

of the West Siberian economy. In this light, creation of the Interagency Regional Commission on Questions of Developing the West Siberian Oil and Gas Complex under USSR Gosplan and its placement at Tyumen' must be noted as positive factors.

L. A. Voznesenskiy: In the modern era it will become increasingly more complicated, difficult and expensive to maintain the achieved level of gas recovery, and even more so to build it up. This is caused to a great extent by the fact that a large portion of the gas reserves are located in our eastern regions, while the main customers for gas are located in the country's central and western regions.

G. D. Margulov: To get an idea of the gas industry's scale of development, let's look at some figures. We increased gas recovery 71 billion m<sup>3</sup> in the Eighth Five-Year Plan, 91 billion m<sup>3</sup> in the Ninth Five-Year Plan and 146 billion m<sup>3</sup> in the Tenth Five-Year Plan. In other words, in 15 years gas recovery rose 308 billion m<sup>3</sup>. During the 11th Five-Year Plan about 200 billion m<sup>3</sup> more will be added to this total.

Yu. I. Bokserman: America took 30 years to reach that growth, while we should do it in 5 years.

G. D. Margulov: Not one branch of industry has known such a scale of development. And, naturally, the question arises: what method enabled these goals to be reached?

The party's Central Committee and our government have for the past 15 years been developing and organizing the introduction of some large programs. One of them is the purposeful and timely preparation for the recovery of new gas reserves.

The industry is being developed on the basis of wide introduction of scientific and technical achievements, an intensification of production and of industrial processes, the creation of new highly effective energy-saving equipment, the concentration of major flows of gas, and a rise in the unit capacity of the operating lines of gas-transport systems. I will cite an example. At the start of 1960, installations for integrated gas treatment with a unit capacity of 3 billion m<sup>3</sup> were built at the Gazli field in the Uzbek SSR (at the time this was the largest field). Today the unit capacity of the operating installations is 20 billion m<sup>3</sup>. Technical achievements also set the pace of development, since unit capacity is increased and capital and material expenditures are reduced, as is time for the construction of gas pipelines and other facilities.

I would like to dwell some more on a very important question--integrated gas treatment. Deep processing of gas with the extraction of valuable accompanying products increases yearly. Large gas-chemicals complexes--Orenburg, Mubarek and others--have been created, where propane, butane and sublimed sulfur are produced in large amounts. The technology of transporting low-sulfur gases over great distances, to be used directly in large electric-power stations, has been mastered. All this supports growth of the industry's economic effectiveness. The pace of producing valuable products for chemistry and petrochemistry also is being raised. Institutes of the USSR Academy of Sciences and the UkSSR Academy of Sciences, the Institute of Electrical Welding imeni Ye. O. Paton, machinebuilders, gas-industry builders and pipe-industry and metallurgical workers are helping technical progress greatly. Along with the growth of production in new regions, stable and strong collectives are being established and excellent personnel are being forged.

Questions linked with increasing construction costs should be dwelt upon. Often one hears over the radio or television or reads in the press that natural gas is a

cheap fuel. This is not at all an accurate notion: actually the recovery and transport of gas cost the state dearly. The fact is that the geography of the distribution of the raw-materials base and of customers for gas has been changed sharply. The raw-materials base is concentrated basically in West Siberia, while the main consumers are in the country's European part.

In order to deliver gas to the consumer, it must be transported a distance of 3,500-4,000 km. Modern gas-recovery enterprises and gas pipelines are large, complicated engineering structures. They are being built in the north under the difficult conditions of swamps, a lack of roads, and low temperatures. Calculations indicate that today more than 100 million rubles of capital investment must be expended for a 1 billion m<sup>3</sup> increase in the recovery of this gas and the transport thereof to the country's central region. The length of our gas pipelines is 135,000 km, three times the length of the Equator.

All these systems must be maintained, all of the pipelines being under high pressure, and every 100 km there is a compressor station. In order to bring gas, say, from Urengoy to Moscow, it must be sent through 35 compressor stations. Substantial material and labor expenditures, including those going to the rehabilitation of production capital, the repair of old gas pipelines, and the replacement of obsolete equipment, are being spent to maintain these gas pipelines and compressor stations. Today, in order to provide for a 1 billion m<sup>3</sup> increase in gas recovery, new capacity for 2.5-3 billion m<sup>3</sup> must be prepared.

With a view to solving these complex problems, our industry is working out and introducing new equipment and technology and a system for automating production control. Right now a number of problems connected with restructuring gas-machinery manufacturing and the pipe industry are being solved with a view to converting to a new, higher class of equipment. Highly effective designs for compressor stations and for gas-field facilities are being created. These measures will enable expenditures to be cut sharply. And the fact that gas is called cheap evidently is associated with the fact that the consumers, especially householders, obtain gas at an extremely low price. And this is a bright manifestation of our party's concern for the workers' welfare. But, as a matter of fact, gas is not cheap; it is a product that is highly valued for its qualities, a product that is difficult to recover and transport, and it can be called "blue gold" with full justification. Natural gas is an expensive energy-bearer, and, in essence, it transforms many branches of industry. Moreover, gas is a valuable raw material for chemicals, petrochemicals and many other branches of industry.

L. A. Voznesenskiy: Of course it is not simple to operate fields in the northern environment, but surely it is still more complicated to ready them for operation, to begin everything, so to speak, from zero, at a vacant spot.

Yu. P. Batalin: I can speak about this, since these questions are resolved primarily by Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises]. For the 10 years of its existence, we have had to implement major national-economic programs and create most unusual pipeline systems, which have no counterparts in the world. Total length of pipelines has reached 230,000 km, including oil pipelines. And if one counts the distribution grids and gas-field and other pipelines, they also will come to about 200,000 km. Therefore, we are now talking about many hundreds of thousands of kilometers. Today not only oil and gas but also products refined from them are being transported by pipeline: gasoline, kerosene, diesel fuel, condensate, ethylene, ethane, propylene and ammonia.

Almost a third of the country's freight turnover goes over pipelines, and two-thirds of the fuel is sent over them. The industry faces major tasks during the new five-year plan: more than 60,000 km of trunk pipelines and more than 20,000 km of pipelines at oilfields and gas fields must be constructed.

I will dwell on construction of the pipelines that L. I. Brezhnev spoke about at the November 1981 CPSU Central Committee Plenum as central construction projects of the five-year plan. Right now they are being erected with a wide sweep. Our industry and its collectives have taken on commitments to introduce each of the six planned pipelines ahead of schedule, 2-3 months before the deadlines.

Much is being said and written today about construction of the Urengoy-Uzhgorod pipeline for gas for export, work on which is being promoted along practically its entire length. There is no doubt that even this gas pipeline will be constructed ahead of the deadlines. And the whole uproar that is being made in Washington and the embargo that USA President Reagan has placed on the sale to us of pipelinelayers and other equipment--none of this will influence the pace of erection of gas pipelines in the Soviet Union. Here is a remarkable fact: in response to these actions against us, the ministry and our local subunits have received literally thousands of applications from skilled workers--builders, equipment operators--asking to be sent to build pipelines, primarily the Urengoy-Uzhgorod gas pipeline. We have enough technical resources to build the gas pipeline on time. But the dearest thing is the patriotism of the Soviet people.

L. A. Voznesenskiy: Pipelinelayers are an important component of the technological chain that helps to build the pipeline. But as is so well known, we have already created a domestic pipelinelayer, whose technical specifications are not only as good as, but even in certain respects better than those of the machines the Americans delivered to us at one time.

Yu. P. Batalin: That is completely true. Its production has been organized in Bashkiria, at the Sterlitamak plant. In operational qualities it has better characteristics than foreign models. Last year we obtained more than 100 of these machines. In the very near future there will be 2-fold to 3-fold more, and by the end of the five-year plan about 1,700 units.

The pipeline-construction process has been completely mechanized. There are now at our disposal such specially produced complexes as those for automatic resistance welding, which was developed by scientists of the Institute of Electric Welding imeni Ye. O. Paton with the cooperation of our industry's scientists. Its welding equipment is very effective. It permits labor productivity to be raised 4-fold to 5-fold and work to be conducted at a high level. By the end of the five-year plan at least 70 percent of all pipelines will be joined by automatic welding. Still another specially produced mechanism for moving soil--a ditching excavator based on the Kirovets tractor--has been created. Its productivity is 1,200 m<sup>3</sup>/hr, being capable of excavating frozen soil of the heaviest category, and a suction dredge has an excavating depth of up to 30 meters; such machines had not been produced previously in our country. Add to this the pipelayer that was mentioned, a ditch backfiller, and a number of other models of special equipment for building pipelines. Thanks alone to integrated mechanization, a sharp reduction in manual labor, and a rise in the worker-to-power ratio (during the five-year plan, we are thinking about raising this indicator at least 2-fold for the industry), we also manage to carry out special-purpose programs and to build up the work pace.



But nevertheless it is not easy to work in the North. We have to overcome permafrost, swamps and lakes, and the powerful machinery that is used during pipeline construction can pass here only when everything is frozen. The construction season is winter, when the temperature often drops below 40-50 degrees C. In the North this lasts for 4-5 months.

Yet the scale of construction in the North is enormous. One can only be delighted by the perspicacity of the party, which has been persistently occupied and will be occupied with the problems of West Siberia, thanks to which it has been possible to create a new, high-capacity fuel and power base for the country.

Yu. I. Bokserman: Let us add that our great experience, which Yu. P. Batalin mentioned, permits us to convert already, during the 11th Five-Year Plan, to a new class of gas-pipeline construction. This refers to the erection of gas pipelines with pressures of 100-120 atmospheres. There are no such gas pipelines yet anywhere in the world. Right now the pressure in gas pipelines is 75 atmospheres. What are we referring to? Given gas pipeline of the same diameter--1,420 mm, its productivity can be increased substantially by raising the pressure. Calculations indicate that, with conversion to a pressure of 100-120 atmospheres, in the near future we can build 15,000 fewer kilometers of gas pipelines and thereby save enormous capital investment. The new solution in the area of gas transport is a priority for Soviet science and technology. In order to put this idea into practice, a group of scientists under Academician B. Ye. Paton has developed a new design--clad pipe. This pipe will be produced by the Vyksa Metallurgical Plant in Gor'kovskaya Oblast.

G. D. Margulov: Simultaneously, gas repumping units of high capacity and other equipment designed for 100 atmospheres of pressure must be created. This is a complicated problem on which the machinebuilders are also working.

Yu. P. Batalin: Of course development of the gas industry is a matter not just for our ministries. It should be resolved together with cooperating activities. Units of high power--25,000 or 16,000 kw, pipes of the new class, pipes with factory-installed insulation, and powerful machinery adapted to the North are to be manufactured, and the reliability of the machines we use is to be raised. Transport organizations must do much work to accelerate the erection of railroads and highways in the areas being mastered, as should aviators, river workers, and maritime sailors.

G. D. Margulov: We have now gone to the Yamburg gas field--the latter is a large field beyond Urengoy, and we have gone to the Yamal Peninsula. A number of questions on the integrated buildup of the West Siberian region are being resolved. Even today we are thinking about preparing in good time for the high growth rates for gas recovery that have been set for the long term. The creation of new equipment and advanced technology is playing a decisive role in accelerating the solution of said problems, and this is the chief factor in raising the operating effectiveness of the gas industry.

L. A. Voznesenskiy: Of course machinery, good work organization and enthusiasm are necessary for successful development of the gas industry. But I, as an economist, am interested in still another aspect of the problem. The press has noted that the total cost of the program for building the gas pipelines is estimated at 25 billion rubles. And since this costs so much, naturally the question arises about the yield from such vast expenditures. How economic is this gigantic construction?

Yu. I. Bokserman: The gas industry is very effective. Last year gas replaced 7-8 million tons of coke in the blast-furnace process. If gas had not been used in the blast furnaces, we would have to build 13-15 high-capacity underground mines to mine coking coal, with the expenditure of enormous capital investment.

Gas, however, not only is a fuel, but, as has already been said, also a valuable chemical raw material. For example, we get from it more than 90 percent of our nitrogenous fertilizer, that is, the very fertilizer that we need the most. And this is one of the important prerequisites for solving problems of the foodstuffs complex. The specific capital investment for making fertilizer from gas is 1.5-fold less, substantially cutting its prime cost. Motor fuel is another use for gas. Refueling is performed at gas-filling stations. Tanks are mounted under the body, and gas is pumped into them at 200 atmospheres of pressure, enough for 300-400 km. Vehicles that operate on gas fuel pollute the air basin of cities and towns much less, since the exhaust contains many fewer different harmful substances. Mingazprom [Ministry of Gas Industry], which has created a special All-Union association, has been given the job of converting hundreds of thousands of motor vehicles to gas fuel. Right now in Moscow, as a result of much work performed by Glavmosavtotrans [Main Administration for Automotive Transport of the Moscow City Soviet], tens of thousands of motor vehicles are operating on compressed gas (butane-propane fractions).

Capital costs in the gas industry are recouped in about 5-6 years. Each thousand cubic meters of gas used in the national economy yields more than 20,000 rubles in savings.

Thus the effectiveness of developing the gas industry is very high, and this is occasioned by the fact that gas not only transforms industrial processes, but it also raises labor productivity, improves working conditions and saves scarce raw materials. All this will enable expenditures for developing this industry to be repaid much more rapidly than is the case for other industries.

One can say with assurance that gas is our national wealth, but, at the same time, questions arise: on the one hand, are we thrifty enough with it in the household and in economic activity? And on the other: are we squandering it, or, in any case, are we using it rationally enough when sending it to capitalist countries?

G. D. Margulov: Important measures have been taken, especially in recent years, to use gas effectively. But, as a check on enterprises that use gas indicates, there are still many deficiencies and neglect, and in some cases gas is being burned irrationally. At some enterprises obsolete instrument designs are being used, accounting for fuel consumption has been set up poorly, gas-burning devices are of unimproved design, and the efficiency of some boilers is low. Therefore, Mingazprom has worked out a special integrated program under the current five-year plan for the rational use of gas in the national economy.

In this connection, it would be well to dwell on this problem. With the growth in the distance that gas is transported--and it has reached, as has already been said, 4,000 km--we are spending ever more energy on repumping it. The problems of bringing large energy-consuming enterprises closer to gas-recovering regions and of building such enterprises in Siberia have arisen. This refers primarily to the construction of high-capacity electric-power stations, in order to meet the ever-increasing demands of this vast region of the gas industry for energy.

This problem will acquire increasingly great significance, if one glances 20 years into the future. The fact is that during development of the fields, formation pressure are reduced, and some of the gas remains in the ground--this is the so-called low-calorie gas. At such giants as Urengoy, Yamburg and others, the remaining reserves are evaluated as several hundred billion cubic meters. Consequently, large energy-consuming enterprises must be brought closer to the gas-recovery sources with a view to using the reserves of gas more fully and to reducing the energy resources spent transporting it.

Mingazprom has developed a special program to use gas rationally within the industry itself by introducing new equipment, including gas-using equipment. Its execution will enable savings of 20 billion m<sup>3</sup> of gas per year.

Yu. I. Bokserman: It must be added that USSR Gosplan is centering its attention on problems of saving fuel. The five-year plan calls for estimated savings of 200 million tons of standard fuel equivalent in 1985 in comparison with the end of the 10th Five-Year Plan.

L. A. Voznesenskiy: A drive for an extraordinarily thrifty attitude toward gas should be held so that each year ever newer, more diverse and, the chief thing, more effective methods for using it will be found.

Yu. P. Batalin: Gas often finds a completely unexpected use. For example, scientists of our ministries have established that it turns out that gas can cure concrete in a way completely different from today's methods. It is known that concrete is steam-cured in chambers. It has been explained, however, that concrete can be readied on a different economic basis by special generators, by means of the direct combustion of the gas in the chamber, for which one-seventeenth the fuel is required, no boilerhouses being necessary, and much more healthful working conditions are created. If all reinforced-concrete plants located in areas where there is gas were to convert to this method of curing the raw material, the country as a whole could save 5 million tons of standard fuel equivalent. Similar research, of course, must continue in order to find new ways and opportunities for the more effective use of gas.

G. D. Margulov: Natural gas must be used thriftily and where it will yield the greatest benefit.

Yu. I. Bokserman: As for the questions of gas exports, a distinction should be made between supplying gas to the countries of socialist collaboration and delivering it to capitalist countries. In supplying gas to countries of socialist collaboration, we are thereby fulfilling our international duty. These countries, in their turn, are taking an active part in creating our gas industry--they send us equipment, pipe, instruments, automation equipment, and so on.

Now about exports to capitalist countries. West European business circles are showing great interest in using gas from the Soviet Union in accordance with L. I. Brezhnev's proposal about collaboration in the energy field within Europe. And the gas pipeline that is being laid from the USSR to Western Europe is testimony of our peaceful striving for relaxing tensions and for mutually advantageous cooperation. All the actions undertaken by the Reagan administration have been aimed against a lessening of tensions and against solution of the difficult energy problems of Western Europe. And this transaction, which has been called the transaction of the

century, is mutually advantageous: we can supply a portion of our gas to these countries and obtain in exchange new machinery, pipe and equipment.

It is sometimes said that we are giving away too much gas. Well, you can judge for yourself: the 40 billion m<sup>3</sup> of gas that we contemplate sending to Western Europe are a very small part of our West Siberian reserves. Therefore, there is no basis for speaking about an encroachment upon our own internal interests.

L. A. Voznesenskiy: Such a most huge national-economic program as that of developing our gas industry affects, of course, not only the economy--it inevitably speeds up the development also of many branches of science, technology and production, and it also speeds up social development in those regions of the country where gas is sent, where it is recovered, and where the gas pipelines pass. This is an illustration of the principle that L. I. Brezhnev emphasized at the 26th Party Congress: the necessity for smoothing out regional social differences.

Yu. P. Batalin: In this connection, this circumstance calls attention to itself: we are beginning to build gas pipelines in nationality districts--the Yamalo-Nenets and Khanty-Mansiysk Okrugs. Many people of the indigenous nationalities are working at these construction sites and at the facilities for recovering and transporting gas. Facilities are being erected here for domestic amenities and for municipal and cultural services for the populace. Communities and enterprises often rise up along the gas pipeline, creating a completely different social atmosphere. As a rule, hundreds and thousands of kolkhozes, sovkhozes and communities are connected up to the gas pipeline, obtaining a very effective fuel.

Let us also note this social factor. Since the gas is being used as fuel, it provides an enormous benefit from the point of view of preserving the environment. In comparison with other types of fuel, gas's combustion products inflict the least damage on it. Cities are becoming cleaner, dust and soot are disappearing.

Yu. I. Bokserman: According to the 11th Five-Year Plan another 25 million people will obtain gas, not only in the cities but also in the countryside. Where there are no gas pipelines, we can supply gas in liquid form, in tanks.

Yu. P. Batalin: At the large fields and adjacent regions, and also along the pipeline routes, cities are being constructed that will become bases for creating other branches of industry there--at Nadym, for example; and the large city of Urengoy is being built. This year our builders have undertaken a commitment to build here 300,000 m<sup>2</sup> of housing space, and also all the cultural and domestic-amenity facilities. There are many such cities, and they are growing up throughout the whole country. In many cases they have become springboards for developing other branches of the economy, and, in essence, also, all the other spheres of life.

G. D. Margulov: I want to add that the gas pipeline needs to be examined in a broad sense, not only as a gas carrier, but also as a heat carrier. It has already been noted that every 100 kilometers there is a compressor station--and these stations are generating enormous amounts of energy.

Yu. I. Bokserman: The power of the installed compressors is equal to the capacity of some of the largest hydroelectric-power stations, such as the Krasnoyarskaya, for example.

G. D. Margulov: That is true. And this is also, of course, great wealth, for the use of secondary heat can yield enormous economic benefit. Gas pipelines pass through several oblasts, over cultivated land. A multitude of greenhouses can be built and large housing tracts organized along this gas pipeline. We are doing definite work with agricultural organs, local soviets and so on, and already a number of farms have been created that use heat from the gas. But in order that the contribution to fulfillment of the foodstuffs program will be more meaningful, more active participation in this by all interested organizations, both branch and regional, is needed.

L. I. Voznesenskiy: But can it be considered on the basis of this data that Mingazprom is stepping up its efforts in terms of establishing businesslike contacts with the Ministry of Agriculture and with other interested organs, so that the enormous heat energy that we have been discussing will not be lost?

G. D. Margulov: Indisputably. In some cases we are already doing this. Large farms have been established. But this is only a partial solution to the question. There is so much heat that this problem must be solved on an industrialized basis.

L. Z. Voznesenskiy: Certainly Gosplan is interested in solving this problem in no small degree?

Yu. I. Bokserman: Of course, USSR Gosplan subunits are very much occupied with this question. A master plan for creating greenhouses in the countryside was examined recently. The experience of recent years indicates that gas can play a decisive role here: it will not only give heat for growing vegetables but it will also enrich the air space of the greenhouses with carbon dioxide, thereby hastening the ripening of the vegetables and increasing their yield.

On the whole, in speaking about gas's social significance, it is a powerful means for the technical reequipping of all or of an extremely large number of industrial processes and for substantially improving domestic-amenities. Nowadays there are no industries, and, consequently, no regions where gas cannot play its transforming role. In this lies, strictly, the enormous social meaning of development of the gas industry, its role in solving tasks of social and economic progress, creating the material and equipment base for communism, and, eventually, of raising the welfare of our country's workers and of developing the internationalization of our economic and all social life, to which special attention was paid in the CPSU Central Committee decree, "On the 60th Anniversary of the Forming of the Union of Soviet Socialist Republics."

Yu. P. Batalin: Right now the industry is promoting wide competition for a worthy greeting to the 60th anniversary of the forming of the USSR. The builders have succeeded in introducing the first of the six Urengoy-Gryazovets-Moscow-Torzhok gas pipelines prior to the deadline, and the country has received a large additional amount of gas. The second Urengoy-Petrovsk gas pipeline is also being erected ahead of the schedule. Its construction has already been completed throughout its entire length, it is being tested, and a portion of it has already been turned on and is giving the country gas. In the near future the gas pipeline will operate at full capacity over the whole distance. It is a major achievement of Mingazprom and Minneftegazstroy builders that these gas pipelines will be introduced in a short time at design capacity. The Gryazovets pipeline, for example, reached this in the

year that it was put into operation. There is no doubt that this year also the Petrovsk pipeline will be introduced at the designed productivity.

Work is being performed on a broad front for erection of the 3,300-km Urengoy-Novopskov pipeline. This is a most complicated engineering structure. Our collectives are committing themselves to constructing it within a year. There has never been anything else like it in either the world or in domestic practice. We have confidence that the patriotism of this industry's workers, technical progress, a rise in the power-to-worker ratio, the attention that the party and the government devotes to us, and the great support of our cooperating machinebuilders, transport workers and workers of all other branches of the economy will enable us to cope successfully with the tasks of speeding up gas-industry development.

L. A. Voznesenskiy: It would seem that today's conversation, which has touched on the most diverse aspects of this problem, has shown convincingly the enormous role of the gas industry in the country's life. We hope that it will in some measure help our readers and workers of the national economy to become better acquainted with the problems of further speeding up the development of this important industry.

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FORECASTING OIL-BEARING CAPACITY OF DEEPLY SUBMERGED JURASSIC DEPOSITS IN  
NORTHWESTERN SIBERIA

Moscow NEFTEGAZOVAYA GEOLOGIYA I GEOFIZIKA in Russian No 6, Jun 82 pp 2-4

[Article by V. P. Stroganov, All-Union Petroleum Scientific Research Institute  
for Geological Survey]

[Text] The phase state of hydrocarbon fluids in the Jurassic deposits in the northern part of Western Siberia are evaluated differently (A. A. Bakirov, A. M. Bridzinskiy, V. I. Yermakov, A. E. Kontorovich, V. D. Nalivkin, S. G. Neruchev, I. I. Nesterov, M. Ya. Rudkevich, F. K. Salmanov, A. A. Trofimov, and others). Since these deposits lie at great (5-7 km) depths in the axial parts of the depressions, many researchers assume that the deep phase of generation of methane prevents an accumulation ("gas" obstacle) of fluid hydrocarbons and the conclusion is drawn that there is a predominance of gas and gas condensate deposits. However, it is known that Jurassic and Triassic deposits are not gas-bearing in all deep depressions; in many depressions there are zones primarily of petroleum accumulation. For example, in deep depressions on the Turanskaya and Scythian platforms, together with the West Siberian platform forming the unified Central Eurasian platform, Lower-Middle Jurassic petroleum and gas parent deposits are in a deep zone of generation of methane (transformation stages  $MK_4$  and above), Jurassic deposits are in the Amu-Dar'ya syncline, Vostochno-Kubanskaya depression, Southern Mangyshlak downwarp, platform regions of Eastern Ciscaucasia, in depressions of the Northern Ustyurt, and Lower Triassic deposits are situated in Eastern Ciscaucasia and in the Southern Mangyshlak. However, in the Jurassic deposits of the Southern Mangyshlaskiy downwarp, Eastern Ciscaucasia and Northern Ustyurt (Beyneuskaya depression) there are zones of predominantly petroleum accumulation, whereas the gas resources are insignificant. The Jurassic deposits in the Amu-Dar'ya syncline and in the Vostochno-Kubanskaya depression contain gas deposits, whereas petroleum concentrations exist in a limited volume; in the Triassic deposits there are zones primarily of petroleum accumulation. Although in the petroleum-bearing zones the Lower-Middle Jurassic petroleum and gas parent deposits lie at lesser depths than in the gas-bearing Amu-Dar'ya syncline and Vostochno-Kubanskaya depression, this deficit of submergence is not the main reason for the noted differences in the phase state of the hydrocarbons, since it is completely compensated by an anomalous increase in temperatures in the Yuzhno-Mangyshlaskaya and Prikumsko-Tyulenevskaya zones. The phase state of the hydrocarbons in the considered Jurassic depressions is not determined by the difference in the depths of presence of productive strata,

but by other factors, as is indicated by the circumstance that the most deeply plunging Triassic rocks contain primarily petroleum concentrations. The lower limit of petroleum content in the Triassic deposits drops down to a depth of almost 5000 m (Kumukhskaya area). Investigations have shown that the presence of petroleum or gas in the depressions is related to the different geological history of the petroleum and gas parent strata of the Jurassic and Triassic. In the plunging of any petroleum and gas parent suite it is possible to distinguish three principal genetic stages. In the first (initial) stage, when the suite passes through the interval of small (from 0 to 1.5-2 km) depths, there is primarily formation of gases of biochemical and early katagenetic genesis, whereas in the OV\* itself there is a preparatory stage for the formation of petroleum. The second (middle) stage in the development of the petroleum and gas parent strata is related to the main zone of petroleum formation -- the MK<sub>1</sub>-MK<sub>3</sub> transformation stage; it occurs in the range of depths from 1.5 to 4 km (60-150°C). The third (deep) stage is caused by the plunging of the petroleum and gas parent strata into the deep zone of methane generation, which is situated below the GZN level.\*\*

In order to solve the problem of why a "gas" obstacle with an accumulation of petroleum arises in some cases in the deeply buried strata, whereas in other cases it is absent, it is particularly important to analyze the first and third stages in the history of the petroleum and gas parent suite. In all the enumerated depressions the Lower-Middle Jurassic and Lower Triassic rocks underwent an identical third stage in the formation in petroleum and gas parent strata. The principal difference is in the conditions for development of the initial stage. In the Amu-Dar'ya syncline and in the Vostochno-Kubanskaya depression the initial stage in the plunging of the Lower-Middle Jurassic deposits was characterized by favorable conditions for the retention of gases of the early generation; here the gas-producing Middle Jurassic rocks by the end of the Jurassic were covered by a reliable chemogenic layer whose thickness in the axial parts attains 2 km.

The initial stage transpired differently in zones whose Jurassic deposits contain primarily concentrations of petroleum. In the petroleum-bearing zones of the Southern Mangyshlak, Prikumsko-Tyulevskiy region and in the Beyneuskaya depression in the Late Jurassic there was a slow plunging of the deposits, together with the clayey-marly rocks there being an accumulation of sandy strata. The thickness of the untouched by pre-Cretaceous erosion Upper Triassic deposits is from 100 to 300-400 m. In these regions the losses of the early-generation gases over a prolonged period of geological time (Late Jurassic -- 21 million years) were an order of magnitude greater than in the Amu-Dar'ya syncline and in the Vostochno-Kubanskaya depression. Poor conditions for retention of early-generation gases were also noted in the Lower Triassic petroleum and gas parent zone. In many areas the deep pre-Jurassic erosion annihilated the stratum of Upper Triassic rocks, and in a number of areas -- the Middle Triassic deposits as well (N. A. Krylov, A. I. Letavin, et al.). In this case the author discovers an important pattern: the gas-bearing zones are formed in deposits where there was an intense phase of methane generation and where the conditions for the conservation of early-generation gases were optimum. On the other hand, intensive gas accumulation is not formed in zones where the early-generation gases were lost, although an intense phase of methane generation occurred. On the basis of this pattern the conclusion was drawn that the

\*Meaning of abbreviation uncertain: a layer designation?

\*\*Meaning of abbreviation uncertain: gas accumulation zone?



intense phase of gas generation in many deep depressions evidently is without independent importance in the formation of gas-bearing zones, since at great depths at high pressures and temperatures there was an exceptionally high solubility of methane in stratum waters. Under these conditions (with a relatively low OV content -- 1-2%) the intensity of formation of the free gas phase at great depths at the expense of methane only of the intense generation phase is unlike in different regions and is dependent on the retention of early-generation gases. In the deposits where early-generation gases were retained, the water-pressure system was plunged into the deep zone of maximum gas saturation and the absorption of methane gas having a high-temperature genesis by water is minimal, the process of formation of the free gas phase transpires intensively, and leads to the formation of gas concentrations. This is precisely what occurred in the Amu-Dar'ya syncline and in the Vostochno-Kubanskaya depression. In addition, in the Amu-Dar'ya syncline the gas-saturated waters, squeezed upward from the Middle Jurassic deposits, were mixed with highly mineralized (up to 300 g/liter) stratum waters of Callovian-Oxfordian age, which favored the degasification of the waters. At the same time, the losses of early-generation gases in the Jurassic and Triassic rocks in the Southern Mangyshlak and Eastern Ciscaucasian zones and in the Beyneuskaya depression had the effect that the water-pressure system was plunged into the deep zone of methane generation with a strong deficit of gas saturation, the high-temperature genesis methane was absorbed by water and the process of formation of the free gas phase transpired weakly and did not result in the formation of major gas accumulations.

Thus, precisely in the initial stage of plunging of the petroleum and gas parent strata in many basins conditions are formed determining the development of gas- or petroleum-bearing zones. For specific Jurassic depressions the critical parameters of the initial stage are related to the Late Jurassic: differences in the thickness and lithological composition of the Upper Jurassic rocks constitute a new, additional criterion for a separate evaluation of the gas and petroleum content of the deep strata.

In the northern part of Western Siberia in the Jurassic deposits the content of OV (according to data from the West Siberian Petroleum Scientific Research Institute for Geological Survey) on the average does not exceed 2%; it is most probable that there are no coal strata in the section. All this is evidence of a considerable influence of the initial stage in the development of the depression at scales of a "gas" obstacle with the accumulation of petroleum at these depths in the depressions. In addition, the low mineralization of Jurassic stratum waters (4 g/liter in the Medvezh'ye area) indicates a high gas solubility of the water-pressure system.

Over the greater part of the territory of Western Siberia the thickness of the Upper Jurassic deposits is 100-200 m, which did not favor a reliable retention of early-generation gases. Accordingly, the gas accumulation processes in the deep strata under conditions of a gasophilic water pressure system transpired poorly. Accordingly, in the Jurassic deposits in the northern part of Western Siberia there are conditions for the development of petroleum concentrations. Although the Jurassic depressions in the northern part of Western Siberia

with respect to depth are close to the gas-bearing strata in the Amu-Dar'ya syncline and in the Vostochno-Kubanskaya depression, they are genetically different (with respect to the initial stage in the development of the petroleum and gas parent stratum) and are more similar to the petroleum-bearing regions of the Turanskaya and Scythian platforms. In addition, in the northern part of Western Siberia it is possible to discriminate the Ust'-Yeniseyskaya zone of intensive Late Jurassic downwarping where the thickness of the clayey rocks of the Late Jurassic attains 900 m. This zone has the best conditions for gas accumulation; the initial stage in the plunging of the petroleum and gas parent stratum of the Middle Jurassic is close to the similar stage in the Amu-Dar'ya syncline and in the Vostochno-Kubanskaya depression. The presence of genetically different Jurassic depressions in the northern part of Western Siberia makes it possible to localize the region having the best conditions for the concentration of resources of fluid hydrocarbons. It is situated at the juncture of the two defined regions, genetically of different types, with favorable and unfavorable conditions for the accumulation of petroleum. In this zone there can be a bringing together of the petroleum generated by two sources: that forming in place and preserved in traps and the petroleum produced by the rocks in the adjacent gas-bearing region of the Ust'-Yeniseyskiy downwarp and driven here by the gas. The most promising region of gas accumulation is situated at the western margin of the Ust'-Yeniseyskaya zone of Upper Jurassic downwarping. It includes the territory of the Gydanskiy arch and regions adjacent to it.

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POTENTIAL PETROLEUM AND GAS RESERVES IN LONG-RANGE PLANNING

Moscow NEFTEGAZOVAYA GEOLOGIYA I GEOFIZIKA in Russian No 6, Jun 82 pp 4-6

[Article by N. I. Buyalov, All-Union Petroleum Scientific Research Institute for Geological Survey]

[Text] The intensive development of the petroleum and gas industry is dependent to a considerable degree on the geological and economic effectiveness of reconnaissance and exploration work, especially on the timely preparation of the necessary reserves of petroleum and gas. Such work is acquiring great importance in new regions of the country where the initial basis for their development is an evaluation of the presence of petroleum and gas, expressed by the predicted reserves. The predicted reserves are not only an index of the prospects of the deep layers, but also the basis for the long-range planning, including the rational distribution of work, material and financial resources.

It is well known that evaluations of predicted reserves are based to a considerable degree on the subjective experience of the researcher, his knowledge of the geological characteristics of structure of the region, his degree of mastery of modern prediction tools. It is possible to take into account the degree of subjectivism in evaluations when making a corresponding analysis; it is more difficult to eliminate the uncertainty of prediction due to the inadequate information on which it is based. It is also well known that a number of favorable geological factors are required for the formation of deposits. In a new region it is possible to postulate their presence only with a certain degree of probability. Accordingly, a correctly prepared scientific prediction, taking into account the uncertainty in initial information, must characterize the probability of the discovery of deposits in the evaluated territory and the possibility of detecting resources of a certain magnitude.

Such a probabilistic prediction, tending to an objective reflection of reality, already is available for the potential resources of petroleum and gas in individual territories. However, such results are probably an exception to the rules: the techniques of a probabilistic prediction are still far from final development and "standard" application.

Fundamental shortcomings of present-day predictive evaluations, expressed in a marked discrepancy in their quantities and a considerable change in the evaluations of the raw material potential of areas as they are exploited -- all this undermines trust in the prediction. However, a failure to evaluate

still undetected resources in effect means that it is impossible to make a long-range plan of the economic development of a territory. The imperfection of today's, much less yesterday's prediction methods, does not mean that it is impossible to improve them.

Data for the territory of the United States most studied by drilling (Fig. 1) indicate that the evaluations of the extractable initial potential resources (EIPR) of petroleum, despite some scatter, over the course of a long period retained a stable tendency to an increase. This was attributable not so much to an initial underevaluation of the resources as to a broadening of information concerning the object being evaluated.

The tendency to an increase in the EIPR evaluations as the area is exploited and the "resource base" concept is developed is observed in most petroleum- and gas-bearing regions. It is postulated that at a definite level this increase is stabilized; a change in the evaluations with time occurs in conformity to the saturation curves. However, in the United States there has been a tendency to a subsequent decrease in the evaluations after attaining a maximum in the second half of the 1960's.

Such a lagging effect as a result of successes is not characteristic for the United States alone. In a retrospective analysis of the EIPR evaluations for petroleum throughout the world a similar picture is observed (Fig. 2).

Similar tendencies in the change in EIPR evaluations of petroleum and gas are also observed in individual explored territories of our country. Thus, a tendency to an exaggeration of the evaluations of resources during the period following the peak of discoveries is a rather common phenomenon and it must be taken into account in long-range planning. The dynamics of evaluations of resources evidently corresponds closer to a model of attenuating oscillations than saturation curves.

However, one must avoid confusion between subjective discrepancies in the evaluations of prospects and the anticipated variations in predictive evaluations. The first constitute disagreements with respect to the most probable quantities of resources and the second represent the minimum and maximum possible deviations of resources from the true resources (with no question about the most probable figure), taking into account the informational uncertainty and in a stipulated confidence interval.

The degree of introduced subjectivism in the predicted quantities of resources is dependent to a considerable degree on the numerous evaluation methods used, which despite this, are based only on three methodological approaches:

on a definite degree of reconnaissance of a territory or on allowance for its change with time -- the method of extrapolation of the smoothed curves of increase in reserves or production;

on a spatial extrapolation of the volumetric or areal densities of resources for explored territories to unexplored territories, taking into account their geological differences and extent -- geological analogy methods;

on modeling of the processes of formation of deposits on the basis of the genetic theory and/or geochemical computations of the material balance. We note that the results of determination of resources are dependent not only on a properly selected method for evaluating the prospects of a territory -- the methods within the framework of each approach are characterized by a different degree of improvement and accuracy. They can be divided into three groups on the basis of the degree of formalization of information processing: expert methods, deterministic - semiexpert and statistical - probabilistic. The first give an evaluation of the geological information, intuitively defining the principal informative relationships. A natural result of such an evaluation is probably a semiquantitative characterization of the degree of prospects, rather than a numerical evaluation.

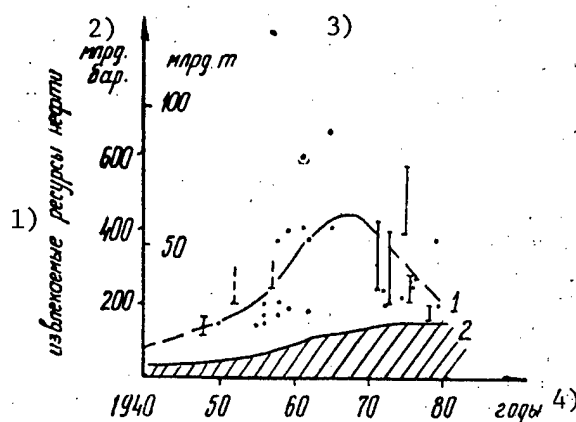


Fig. 1. Dynamics of evaluations of initial potential extractable petroleum resources in United States. 1) evaluation of extractable petroleum resources (reserves + accumulated output).

KEY:

- 1) Extractable petroleum reserves
- 2) Billion barrels
- 3) Billion tons
- 4) Years

Deterministic methods are based on the idea of the existence of functional dependences between the quantity of resources in the deep layers and the geological and physical parameters of objects or their fields. Thus, in a comparison of the predicted evaluations obtained by different methods it is important to bear in mind that expert evaluations are a very rough approximation in comparison with deterministic evaluations, which differ from statistical - probabilistic methods in having a lesser accuracy.

The method of a quantitative evaluation of the actual soundness of a prediction is based on the entropy concept applicable to petroleum and gas resources. It makes it possible, using a hierarchical scale, to give more detail concerning the evaluated object depending on the geological study of the territory and the presence of commercial deposits, and also to define a number of uncertainty levels for the prediction. Each level characterizes the degree of relative

variance of the predictive evaluations at a particular stage in geological study. In the case of a nonuniform regional study the level of evaluation of a complex object is computed as the mean weighted value for the relative fraction of components of elementary objects of different levels in the resources.

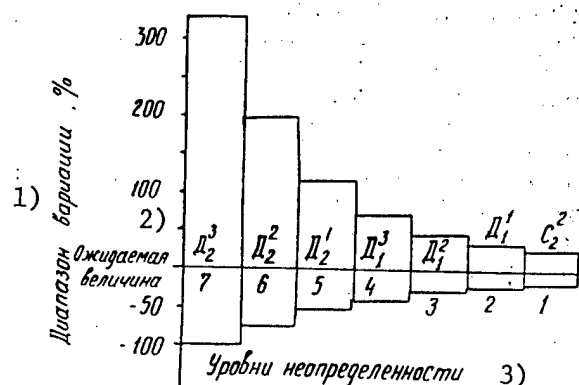


Fig. 2. Variance of evaluations of petroleum and gas resources.

KEY:

- 1) Range of variation, %
- 2) Anticipated quantity
- 3) Uncertainty levels

Table 1

Petroleum and gas province, region	Mean level of uncertainty of prediction, %	Range of variation of prediction relative to mean, %	Mean annual realization of prediction, %
Timano-Pechorskaya	2.9	-25 + 36	2.6
Western Siberian	3.1	-28 + 43	2.7
Far East-Sakhalin	3.2	-	2.3
Baltic	4.0	-	1.0
Eastern Siberian	5.3	-	0.1

In computing the admissible limits of variations of regional predictive evaluations for different levels of their actual validity use is made of evaluations of the variation coefficients for statistical-genetic models of different complexity. The analysis indicated that the distribution of specific densities of the initial potential petroleum and gas resources is close to log-normal. Accordingly, the anticipated deviations from the most probable figure in the direction of their increase will be greater than in the direction of a decrease (the expected logarithms of the deviations are identical). At the same time it is necessary to determine the most probable value (mathematical expectation) as the mean geometrical rather than the mean arithmetical value.

It follows from the entropy (augmentation of information) formula that the uncertainty does not decrease uniformly, but exponentially.

The condition of correctness of the indicated limits of the variations is a nonbias of the most probable value, assuming allowance for all available petroleum geology information, absence of systematic errors in the prediction process -- the adequacy of the method.

On the basis of the considered concepts computations were made of the indices of actual validity of recent predictive evaluations of the presence of petroleum and gas for a number of major regions in the USSR (Table 1).

When using evaluations of undetected resources for the purposes of long-range economic planning it must be remembered that without an analysis of the validity of the predictive evaluations of resources they are ill-suited for long-range planning and it is difficult to compare them with one another or sum them.

As a criterion of the objectivity of the anticipated quantity of undetected resources it is possible to use the perfection of the employed prediction method with respect to the completeness and diversity of coverage of available geological information. Statistical - probabilistic methods are most correct, although their theoretical validity is not always adequate.

The objective method for determining their uncertainty level, closely related to the variance of the evaluations and the rates of their realization, gives a characteristic of the actual validity of the predictive evaluations.

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## FUELS

### PROGRESS, PROBLEMS IN KUZNETSK COAL BASIN DESCRIBED

Moscow PRAVDA in Russian 30 Jun, 1 Jul 82

[30 Jun 82 p 2 Part I]

[Article by A. Bogachuk and S. Vtorushin, special PRAVDA correspondents:  
"Kuzbass Coal"]

[Text] "Increase the coal extraction in the Kuzbass."  
(from the Basic Directions for Economic and Social  
Development of the USSR for 1981-1985 and for the  
Period to 1990).

#### 1. Untouched Beds

The superhighway wound around hills and ravines. Sometimes it approached right up to the railroad. Each time an enormous car loaded with coal rushed towards us. We then saw how this coal was lifted to the surface by conveyers and skips and how the excavator buckets dug into the open pits. The miners' cities and settlements were built in an unending line. The mining profession is the chief in the Kuzbass.

The Kuznetsk basin will provide the country with almost 150 million T of fuel this year, and 60 million of them will be the most valuable coking coals. Kuzbass is becoming the main supplier of this raw material for the metallurgical industry. The specialists assert that the basin in the future may yield up to 400-500 million T of fuel every year. There will be sufficient reserves in it for a thousand years even with this rate of extraction.

There are many enterprises here which are the glory of the sector. The mine "Raspadskaya" by right is called the flagship of the coal industry. It yielded 6 million T of coking coal last year. The brigade of the Hero of Socialist Labor V. Devyatko, one of the first to reach the millionth mark for fuel extraction here is famous beyond the basin.

In building "Raspadskaya" the USSR Ministry of the Coal Industry tried a bold experiment whose essence was to create a mine of the future. Here there is no rail haulage which is traditional for the miners: all the coal is carried from the face to the surface on powerful conveyers. Modern mechanized complexes have been installed in the longwalls. Over 90 percent of the underground shafts are tunneled by combines.



The creation of this mine required major capital investments of course. But the outlays have already been more than compensated for. Comprehensive mechanization and the leading technology guarantee high production efficiency. Labor productivity at "Raspadskaya" is almost triple the average for the sector and is 140 T per miner per month, while the expenditures per ton of coking coal do not exceed R 7.5. Each mechanized face produces an average of up to 1,500 T of fuel per day.

The miners from the mines imeni V. I. Lenin and "Zyryanovskaya," "Nagornaya" and "Yubileynaya," imeni 7 November and imeni Dzerzhinskiy, the open pits "Krasnogorodskiy" and "Chernigovskiy" and other coal extracting enterprises are successfully operating in this five-year plan.

The Kuzbass is one of the first basins in the country where the movement of "1000 producers" was developed. Now there are over 100 mining brigades producing a thousand and more tons of coal per day. Among them are the collectives of the Heroes of Socialist Labor M. Reshetnikov, Ye. Drozdetskiy, A. Nikitin, A. Popov and many others who are known throughout the country. The brigade of "1000 producers" is responsible for about 60 percent of all the underground extraction.

The open-pit method of fuel extraction has received wider scope in recent years in the basin. Every third ton of coal now comes from the open pits. In the future, the main increase in extraction will be obtained by open-pit working of the fields. This is understandable: labor productivity at the open pits is triple that in the mines, and the net cost of the extracted fuel is half.

The collective of the open pit imeni 50th Anniversary of October has become a pioneer of open-pit working in its time. Last year the enterprise shipped to the consumers 4.5 million T of coal and covered the rated output.

"The primary emphasis," relates the director of the open pit, Hero of Socialist Labor I. Litvin, "is made on enhancing the skill of the workers and the efficiency of production. Every miner has mastered two-three occupations. This made it possible to use the equipment competently and with high output."

Radical reconstruction of the open pit is now underway. It is planned to increase fuel extraction here to 12, and further to 20 million T per year. A transition to continuous technology, the introduction of powerful highly productive equipment are stipulated. The collective of the open pit was the first in the sector to master the open-pit working of coking coals. It will be almost half of all the extraction.

Construction of one of the country's largest coal pits has begun, "Taldinskiy" with annual output of 30 million T of fuel. The first coal has been obtained by open-pit method at the Karakanskiy field. In the opinion of the specialists, open-pit extraction of fuel in the basin could be raised to 100 million T in the next 15 years.

The Kuzbass miners are boldly introducing advanced technology of working the coal beds. One of these directions is the hydraulic method. The country's only association "Gidrougol'" is operating in Novokuznetsk which in addition to miners includes a scientific-research institute and a plant for production of hydraulic equipment. This cooperation makes it possible to rapidly create and master new equipment and improve the technology of coal extraction. The advantages of this technology are that it makes it possible to successfully work the most difficult beds where it is impossible to use modern means of comprehensive mechanization. It is especially effective in working thick steep beds. It is also very important that the hydraulic method creates the safest working conditions for the miners.

The enormous coal formations and the possibilities for their rapid development with the minimum outlays makes the Kuznetsk basin our main stokehole. Moreover, the growing needs of the country, and primarily its European sector, for high-quality fuel can be satisfied by developing the Kuzbass. However, the potentialities of the basin are still not being sufficiently utilized. For 5 years already the miners have not been able to cross the 150-million mark of annual extraction. Last year they underproduced 5 million T of coal for the state plan. The assignment for rise in labor productivity was also not fulfilled. There is one reason here: the internal reserves are being actuated slowly and there is great idling of equipment because of organizational confusion. But the lagging in the mine reconstruction was also instrumental. New facilities have not been created here for a long time.

"In the last 15 years," notes the first secretary of the Kemerovo CPSU obkom L. Gorshkov, "the USSR Ministry of the Coal Industry has not made a single new mine for us, although the effectiveness of the capital outlays here is double-triple that in any other basin."

It is impossible to say that the leadership of the sector has underestimated the importance of the Kuzbass. Many orders and decisions have recently been issued aimed at the development of the "Siberian stokehole." However many of them were not reinforced by specific actions.

This places the miners in a complicated situation. Striving to fulfill the plan at all costs, they are often forced to abandon the most efficient plans for working the fields. Many of the mines, despite the large coal reserves, were practically without a work front.

The miners are not sitting with folded arms of course. Many mines have set up subdivisions which are doing the reconstruction with their own forces. Last year they performed work for R 55 million. This made it possible to create a stable stopping front at the mines imeni V. I. Lenin, 7 November, "Kapital'naya" and some others. Not only the reconstruction is being carried out by economic method, but also the construction of the so-called pioneer blocks of the future mines. These are essentially small mines which with time will become modern extracting enterprises.

Reconstruction by in-house forces under the created conditions becomes a wise course. The forces of the miner-builders are extremely limited. This

is why it is most expedient to concentrate them on building new large facilities. The Ministry of the Coal Industry, however, has provided R 3 million less for the method than actually assimilated last year.

The basin does not make full use of such an advanced method as hydraulic extraction. Three years ago PRAVDA raised the question of switching the mines of Novokuznetsk to it. By the way this is where the association "Gidrougol" was set up. The expediency of this step is not denied by anyone today. Hydraulic extraction is the most labor saving technology which with an acute shortage of workers will yield more product with fewer people. But the question of switching the enterprises from the association "Gidrougol" has not yet been resolved.

Many of the miners that we met advised that equipment is operating at the mines and open pits of the Kuzbass that have not been adapted to the existing conditions. Thus, at "Raspadskaya" they have been forced to use stoping complexes that are not capable of taking coal for the entire thickness of the bed. The collective leaves 500,000-600,000 T of coal prepared for extraction in the depths every year for this reason alone.

There are a number of plants in the Kuzbass which produce mining equipment. The Kiselevsk Plant imeni I. Chernyye manufactures mechanized timbering. Unfortunately, only some of them are suitable for the basin mines. The local party and soviet agencies have repeatedly raised the question to the Gosplan and the USSR Ministry of the Coal Industry of reconstructing the machine construction plants, setting up output of modern equipment for the Kuzbass at them. There are no basic objections to this, however the problem remains unresolved.

The base for repair of the mining equipment is also growing slowly. There is essentially no place to restore bulldozers, excavators and traction engines for diesel-electric locomotives. The majority of mechanized timberings are repaired under semiprimitive conditions directly in the mines or in small workshops of the production associations.

Lagging of capital construction, reconstruction of the mines and open pits, and insufficient output of the machine construction and repair base naturally restrict the development of coal extraction. But these are not the only reasons which obstruct greater output from the miners. The solution to urgent social questions is not less important for improving the efficiency of the coal extracting enterprises' operation. The next correspondence will cover this.

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[1 Jul 82 p 2 Part II]

[Text] 2. Home for the Miners

It would seem that the mud volcanoes parted especially to provide a place for the city. It developed in a broad valley between the Tom' and Usa Rivers,

and so was named Mezhdurechensk. Even by Kuzbass concepts it is considered to be on the outskirts, the wild Siberian taiga stretches further by hundreds of kilometers.

From the very beginning, Mezhdurechensk was set up as a city of coal miners. Four-fifths of the housing, facilities of social-cultural-general and communal services are now built by the capital investments of the sector. There are no traditional settlements pressing up to the dumps or so-called temporary housing here. The multistory city with a population of 100,000 is compact, well-organized and has everything necessary for complete living.

This is one of the few cities where the plan for housing is constantly fulfilled. Last year, for example, the miners obtained 5,000 m<sup>2</sup> of apartments more than stipulated by the assignment. Reconstruction of the house-building combine was recently started. It will begin to produce housing of improved layout. The city party organization has set the task of mastering two annual plans for the reconstruction of house-building combines.

Concern for improving the life and daily welfare of the miners and creating conditions for them for highly productive labor has become the chief business of the party committees, mine and open pit administrations, and the city organizations. All the mining collectives have set up well organized recreation centers, pioneer camps and kindergartens. There are over 5,000 garden plots next to the city.

All of this could not help but affect the strengthening of the cadres, reduction in the turnover, and in the final analysis, the results of the coal miners' work. In the last five-year plan, the increase in fuel extraction at these enterprises was 5 million T. It is planned to produce the same addition in this five-year plan as well.

The collective of the open pit imeni 50th Anniversary of October is proud of its settlement. In the last three five-year plans, the quantity of well organized housing has tripled. New stores, schools and general services enterprises have been built. The miners themselves asphalted the roads and sidewalks and planted over 40,000 trees.

Almost everyone in the settlement is studying. In recent years about 500 workers of the open pit have completed the school for the young worker, and 200 people have graduated from the technical schools and VUZ's. A love for mining is being instilled in the young people. It is no wonder that 70 percent of the secondary school graduates, supplementing the worker dynasties, remain in the settlement every year. All of them by this time have succeeded in acquiring a specialty of assistant excavator machine operator, heavy trucks, etc. This is the main secret of the collective's success. The average monthly wages for each miner here is one of the highest in the basin.

But there are not so many of these examples in the Kuzbass, or in the sector for that matter. In the association "Kemerovoúgol'" we heard these figures: over 9,000 people are waiting in line for housing and many children are waiting for openings in the kindergartens and nursery schools. Last year alone over 70,000 m<sup>2</sup> of housing was underproduced for the basin miners. In the last five-year plan, they obtained 300,000 m<sup>2</sup> less than planned.

An especially difficult situation has developed in Prokop'yevsk in Kiselevsk, old cities of the Kuzbass. A considerable part of the housing fund is not well organized in the second city. Many houses are in an emergency state.

"A decision was adopted not so long ago," relates the first secretary of the Kiselevsk CPSU gorkom Yu. Torubarov, "for the social and economic development of Prokop'yevsk and our city. This is the only case of its type where the old cities will essentially be able to move to a new place. Then we will collect the millions of tons of coal left in the marginal blocks."

New housing centers have already been set up here. The main development is concentrated around them. The second phase of the house building combine was started up quite recently in Prokop'yevsk. When it opened, the output for house building in the city rose by 2.5-fold. A similar enterprise is under construction in Kiselevsk. The construction rates nevertheless do not correspond to the needs of the cities.

In the Kiselevsk CPSU gorkom we were shown a letter sent to the party committee by the wives of the brigade foremen from the mine "Kiselevskaya." Some of them have been living with their children in hotel type dormitories for over 10 years.

"We will help them," the gorkom said. "But this is not easy."

At the same time the program for housing construction is not being fulfilled. In 1979-1985 it was planned to build almost a half million square meters of housing in the city. Half the time has passed, and only 130,000 m<sup>2</sup> have been settled. But even from the amount which had been completed, very little was assigned to those waiting. Twenty-two apartments were recently allocated for the same mine "Kiselevskaya" of which 16 were given to the families whose houses had been demolished. In Prokop'yevsk, only one-third of the apartments are given to those waiting. The others go to improve the living conditions of the people who have been moved from decrepit housing.

The new housing centers of Prokop'yevsk and Kiselevsk suffer from the same misfortunes as many young cities of Siberia. In Kiselevsk, for example, 1,200 mothers stay at home because of the shortage of places in the kindergartens and nursery schools. In the microrayon Krasnyy Kamen', where the main development is underway, there are only two stores for the 15,000 residents. The network of general services enterprises is expanding slowly.

The USSR Ministry of the Coal Industry and the USSR Gosplan are largely responsible for the poor development of the city. A general self-service store and a covered market, Palace of Pioneers, some facilities of communal services and a gas station were eliminated from the program for social and economic development of Prokop'yevsk.

Lagging in housing construction and social development of the cities primarily has an effect on the supply of cadres for the coal enterprises. Of the nine mines in Kiselevsk, only two are complete. There is roughly the same situation in Prokop'yevsk. A constant shortage of cadres has become one of the main reasons for reduction in coal extraction in the Prokop'yevsk-Kiselevsk region. What is the solution?

The combine "Kuzbasszhilstroy" is the main developer of the mining cities. It is currently faced with producing 340,000 m<sup>2</sup> of housing. The builders have announced in advance that they are not capable of fulfilling this program. At the same time the annual output of the house building enterprises is 460,000 m<sup>2</sup>. Why is it not completely utilized?

By increasing the output of the house-building combine, the builders lagged in the creation of other bases and auxiliary enterprises. None of the trusts of "Kuzbasszhilstroy" has an administration for production-technological procurement. There has been a delay in the reconstruction of the wood processing combine. This means that houses leave the house-building combine without windows, doors or glass. As a result, with a shortage of workers there is a drastic increase in the labor outlays at the construction sites. The work is also being slowed down because of the slow laying of engineering networks and pipelines: there are no corresponding specialized subdivisions in "Kuzbasszhilstroy." Moreover the housing program of even this year is not supported with material resources. Metal, cement and other materials have been allocated without consideration for the natural-climate conditions of Siberia where the specific outlays for materials are higher than in the central zone of Russia.

One of the acutest problems is supply of heat to the mining cities. There are 3,600 small boiler houses operating in the Kuzbass. There are over 300 in Prokop'yevsk alone. Over a thousand people are employed to maintain the boiler houses. This is the staff of a mine with annual extraction of over a million tons of coal. Now an autonomous source of heat is being built in each new microrayon. For many years the miners have been striving to build a TETs. Its construction has been included in the plan for social and economic development of the city. But the power engineers are not hurrying.

Kuzbass is a true coal gem of the country. It has no equals either in reserves or in the fuel quality. The basin plays the most important role in the state economy. Its outlook and importance are continually expanding. In the last 15 years, coal extraction here has risen by 50 million T per year. But currently these rates no longer correspond to the demands of the national economy. There are great potentialities for accelerated and effective increase in extraction. This was discussed directly at the 26th CPSU Congress.

The miners of the basin still have many problems. The successful work not only of the Kuzbass mines and open pits, but also the entire coal industry of the country depends on their most rapid resolution.

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## FUELS

### EQUIPMENT TO FACILITATE MINING WORK DISCUSSED

Moscow PRAVDA in Russian 2 Jun 82 p 2

[Article by A. Dokukin, corresponding member of the USSR Academy of Sciences, director of the Institute of Mining imeni A. A. Skochinskiy: "Complexes for the Miner"]

[Text] The mining profession is one of the most honorable. Who does not know the two-time Hero of Socialist Labor I. Strel'chenko from Donbass, Heroes of Socialist Labor G. Smirnov from Kuzbass and M. Chikh from the Rostovskaya Oblast! There are many true masters of work and talented experts in the sector. The country is successfully solving its fuel and energy problems because of the work of these people. Production efficiency and labor safety have significantly improved at the mines. This means that the prestige of the mining specialties also rises.

In contrast to other sectors of industry, the coal industry depends on nature to a considerable degree. The depth of the shafts, geological disruptions in the occurrence of the beds, accumulation of gas, mining-dynamic phenomena all are factors which complicate the work of the miners. This is why constant attention is given to improving conditions and safety of their work in our country. The requirements made in the coal industry for these conditions have been reinforced by a number of legislative and standard documents.

It should be said outright that enormous work has been done. In the last 20 years the mines have changed so as to be unrecognizable. The drilling machines have been replaced by powerful combines. Almost three-fourths of the coal in the mines is now extracted in comprehensively mechanized faces where the young miners do not know what kind of work it is to set a longwall when it is reinforced with wooden supports.

Comprehensive mechanization has considerably reduced, and in some cases even eliminated heavy manual labor. By the end of the 11th Five-Year Plan, its level at the stoping operations will be brought to 74 percent versus 67 percent reached in 1980. The new complexes KM-103 and the updated KM-97 with combine and grader extraction will be used on the thin beds. Their series production has already been mastered at the Kamensk machine construction plant.

It is safer to work in these "iron" longwalls, as the miners say. It is also easier. The conveyer and the timbering sections are advanced with the

help of hydraulics. But the natural phenomena which are undesirable for the miners of course still exist. Today solid scientific forces are involved in the problems of subduing them.

The most threatening and dangerous enemy of the miners is methane gas. An enormous quantity of air has to be continually fed into each mine in order to ventilate the faces. About 30-40 percent of the consumed electricity is spent for these purposes.

With a rise in coal extraction there is an increase in the requirements for reliability and efficiency of this complex business. It is necessary to set up series production of highly productive axial ventilators for main ventilation more quickly. They are manufactured by the Artemov machine construction plant. Production is developing slowly here, therefore the miners' orders are not completely satisfied. As they say, there is food for thought here. It is difficult to say why the output of powerful local ventilation fans is being slowly mastered at the Tomsk plant of Soyuzuglemash.

The powerful fan VMTs-8 which was put into series production was also unlucky. The fact is that it requires pipes 800 mm in diameter. The Ministry of Oil Refining and Petrochemical Industry mastered their output. Only the misfortune is that the quantity was low. The Ministry of the Electrical Engineering Industry also failed. It only satisfied the order for small-sized explosion-safe electric motors for these fans by half. Consequently, in every third preparatory face the workers had to install two-three low-power fans.

In addition to traditional methods of controlling gas by intensive ventilation of the shafts, new trends are developing at rapid rates. A comprehensive scientific-technical program which primarily stipulates the creation of effective methods of degasification, physical-mechanical and hydro-impulse has been formulated for the 11th Five-Year Plan with the participation of the USSR Academy of Sciences.

The task has been set of removing the restrictions for the gas factor and completely guaranteeing safe and productive work in all the stoping and preparatory faces without exception. A search is presently underway for basically new methods of timely removal of methane from the coal bed and rock during the preparation of the field for extraction. Combined methods are being formulated for degasification of coal beds from the surface and from the mine shafts, and more effective methods of working the explosive coal beds. Automated systems for guaranteeing safe mining operations with the use of a computer are being made.

Automatic apparatus of remote control and complexes "Metan" have already been installed at 380 mines. They signal to the dispatcher point of a concentration of methane in the faces, and in case of danger turn off the electricity and issue a command for immediate evacuation of people from the shafts. These automatic monitors have been installed at the majority of coal mines.

Services for predicting and preventing sudden blow-outs of coal and gas are already functioning at 130 mines. The seismoacoustic monitoring of the rock



has been extensively used. The apparatus indicates an increase in the pressure of the rock massif and the danger of blow-out of coal, gas and rock. This makes it possible to halt mining operations in time. It has been introduced in 119 stoping and 4 preparatory faces of 52 mines.

The creation of technological plans and special methods for preliminary degasification of the rock massif and the coal beds is very important. Many coal enterprises will receive innovations in the current five-year plan.

Scientific studies made in recent years made it possible to establish the laws governing the emergence of blow-outs and promoted the rapid introduction of preventive measures. Now the number of blow-outs has been reduced by half. However the struggle with them cannot be halted. New scientific efforts have been applied to this important problem, a number of academic institutes. In order to coordinate the combined creative searches, a special scientific council has been set up under the presidium of the USSR Academy of Sciences.

Geophysical apparatus which makes it possible to use reflected waves to determine the structure, including geological disorders of the coal bed in the extraction field will become widespread in the sector. The miners will be able to prepare in advance to encounter these disorders. The innovation is already being prepared for transfer for assimilation at the plants of the Ministry of Instrument Making, Automation Equipment and Control Systems.

Attributing great importance to the development of comprehensive mechanization and maintaining the mine shafts under complicated mining-geological conditions, the USSR Ministry of the Chemical Industry has been entrusted with developing new binding materials based on polyurethanes for reinforcing unstable rocks in the mines, and the Ministry of Chemical Machine Construction and Soyuzuglemash have been entrusted with creating equipment for injecting them into the rock massif and mastering its output.

Of course there are a lot of difficulties in this great work. But they are associated not so much with the formulation of ideas, as with the organization of the work. A "green light" should be given to the equipment called upon to make the miners' work safe. It must have the right of primary output. The market for it should naturally rise.

There are unfortunately many facts when the orders of the miners are still not completely satisfied. Even a schoolchild knows that the temperature of rocks increases with depth. In some faces at depths of 800-1000 meters it reaches 30-40°. It is simply impossible to work under these conditions. Consequently, mobile, and in a number of cases stationary air conditioners with high output are installed in the mine. They help to create a normal thermal regime in the mine shafts. The demand of the sector for air conditioners is not satisfied however. The Odessa plant "Kholodmash" of the Ministry of Chemical Machine Construction is primarily responsible for this. It is slow to expand the production of the mine air conditioners, and is not very concerned about their productivity and reliability.

There are many similar problems with dust suppression. The output of highly effective and reliable sprinkling systems, dust suppressing units should be increased. They considerably improve the mine atmosphere. The miners are

also waiting for the pumping units with automatic regulation of liquid injection into the coal bed and effective wetting agents "Sintanol DT-7." The new equipment which corresponds to the sanitary norms for dust, vibration and noise, including the combine KSh-ZM with hydromechanical actuating mechanism and pneumatic tunneling machine of Ya. Ya. Gumennik with hydraulic-pneumatic sprinkling should be given the "green light" for series production more rapidly.

The efforts of the scientists and designers are currently concentrated on creating technology and equipment which excludes the need for constant human presence in the stoping face. This considerably transforms the work of the miner. Drilling-worm extraction of coal will be developed on the gently sloping beds, and on the steep--drilling extraction. Consequently the Kopeysk machine construction plant must accelerate the series production of the drilling-worm machine BUG-2. The automated tunneling machine PPG-2 is already being tested for making shafts on steep beds and the documents for its series production will be prepared. It will permit a four-five-fold increase in the rate of tunneling for coal and will bring it to 50 meters per hour.

Work to create automated units with hydraulic timbering controlled in the bed plane is in the center of attention. It is planned to create the first two automated mines in which coal extraction in the stoping faces will not require the constant presence of people.

A lot has been done in recent years in the Donets, Kuznetsk and other basins for construction and reconstruction of general combines, cafeterias, dispensaries and construction of housing. In the recently adopted decrees of the CPSU Central Committee and the USSR Council of Ministers, new major measures in this direction have been outlined. The conditions and safety of work and production efficiency will be raised to higher levels. New, highly productive machines and complexes will be made, including for extraction of coal without the constant presence of people in the face. It is planned to comprehensively mechanize operations in the beds with especially complicated mining-geological conditions. The decision to raise the rates for the miners and the official salaries, and to improve the organization of the sector's wages was met with great approval.

All of this will continue to foster an enhancing of the prestige of the mining profession and the complete exposure of workers' talents.

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## FUELS

### KARAGANDA COAL OUTPUT DROPS, EXPENDITURES RISE

Moscow TRUD in Russian 14 May 82 p 2

[Article by A. Shurdumov, TRUDA public correspondent and A. Bugayev TRUDA correspondent: "How They 'Saved' the Plan"]

[Text] The former glory of the Karaganda workers in the effective extraction of valuable coking coals by underground method has literally begun to diminish before our very eyes. Balancing on the border of interrupting the state plan began 2 years ago.

The feverish search for a resolution to the situation led the leaders of the association to the small place of Borly which is located over 100 km from the oblast center. Coal, although it is very poor, lies underfoot at they say: one only needs to bulldoze off the top layer of ground and dig a full shovel-full.

Last year the situation of the miners who extract fuel by the underground method did not improve at all. And there was no special attempt made to pull up the lagging rear forces. This required capital and time, but it was overlooked.

It is well known that lagging in the preparatory operations today is a collapse in fuel extraction tomorrow. However the leaders of the association "Karagandaugol" have long been ignoring this truth. Starting in 1975, the basin tunnelers did not fulfill the plan for preparatory operations even once. Last year alone there were over 43 running kilometers of incomplete mine shafts on their conscience. Eighteen of the 26 coal enterprises did not cope with the plan for tunneling. The miner-extractors did not obtain 12 planned longwalls. This is one of the basic reasons for the unsatisfactory work of many mines for coal extraction which have underproduced over a million tons.

The basin this time nevertheless was not among the laggards: they were rescued again by the Borly open pit. The association dotes on this game of hy-spy.

The chief engineer of the board for major construction, Viktor Aleksandrovich Tobler, has a whole philosophy about this.

"Judge for yourself," he "enlightened" us, "what is more profitable: to build a mine, spending R 120-130 million and a lot of time, or for R 5 million which we spent last year in Borly, to obtain almost 4 million T of inexpensive fuel?"

But is the Borly coal cheap? The net cost of each ton of it is R 7 and 49 kop. This is several times over the outlays of the neighboring Karaganda workers, the miners of the association "Ekibastuzgol" where extraction of a ton of fuel only costs R 1 and 35 kop. The total Borly expenditures rounded off are R 29.201 million, but they prefer not to talk about this in "Karagandaugol".

It is altogether the very time to investigate and start talking.

The development of the Borly field was started in a hurry, off-hand, without including construction of the object in the plan. Presently in Borly, except for the extracting equipment, trucks and several coal warehouses, there is nothing. It is a wonder how people work here. But we are not discussing the people. The plan has to be saved. At any price. And it is saved.

All the coal is hauled from here by trucks for tens of kilometers. Of the R 7 and 49 kop. that the association spends on extracting 1 T of Borly coal, R 6 and 87 kop. are spent for transportation costs. Last year the truck costs were R 24.986 million. Can this really be tolerated!

But it is not only the coal miners who are coughing up money for the shipment of the Borly coal. The transporters of the Karaganda freight truck administration and other 10 oblasts of the republic have been involved voluntarily or involuntarily in the waste. The truck administration of the association "Karagandaugol" annually allocates 1200 trucks and other oblasts command up to 500 trucks with trailers.

"What is Borly for us?" says the head of the truck administration V. Datsyuk. "A total of 1,240 T of fuel were overconsumed, and tens of thousands of rubles were spent to restore the malfunctioning rolling stock. The plan for labor productivity and profitability of the shipping was not fulfilled. The republic's best truck administration has moved from the leader to the lagger."

The trucks allocated to the coal miners are used wretchedly or simply driven into the ground. Of the 1,200 trucks, only one-third are in continuous operation. The others are listed in the column "premature removal from the line." The severest 85-kilometer coal route from the intermediate warehouse to the railroad station of Kuu-Chek takes its toll. The latest KamAZ's often "run" no more than 5,000-6,000 instead of 300,000 kilometers.

The truckers lost 3800 machine-days last year in Borly because of breakdowns and accidents. These trucks could have hauled an additional 130,000 T of freight with freight turnover of 117 million ton-kilometers.

What about the truckers' working conditions? The drivers have to live for several months of the year in unadapted rooms which do not even have drinking water. By the way, a large number of drivers who participate in coal shipments are on assignments. The association "Karagandaugol" naturally takes

responsibility for paying them. This is what the Borly coal cost, and the striving to fulfill the plan at any price.

There is no doubt that coal extraction by the open-pit method has to be increased. Only this needs to be done in a planned manner, with regard for all the requirements of socialist management and not in detriment to the underground extraction.

The majority of mines of the Karaganda basin produce valuable fuel for coking. However many of them are lagging greatly in their development. On the whole the basin needs no less than a year to make up for the omission. The work on unfinished levels causes great concern for the miners. The misfortune is that all the technological processes and the operations associated with them, electricity supply, transporting of the hammered out mass of coal and rock, shipment of materials and equipment to the faces, water bailing and ventilation, are done on temporary plans. All of this considerably complicates the matter.

The collective of the mine imeni V. I. Lenin has been working for almost 10 years under these conditions. There has recently not been a single meeting or gathering of the coal workers where the representatives of the enterprise did not raise the question of starting up the second level. But the appeal of the miners has remained a voice in the wilderness. They have to work under difficult conditions. Having almost exhausted the coal reserves at the second level, they are already extracting from the third. Its construction was not even stipulated in the current five-year plan.

"What kind of competition is there! say the miners. "We work on the emergency-fire system."

A similar situation has developed at the mine "Maykudukskaya." The first phase of the new level has been under construction here for several years. When it was finally officially opened, the fuel had already been exhausted. Last year the enterprise underproduced 270,000 T of coal. The periods for the end of building the second phase are also continually carried over. Now they are planned for 1984.

Another nine coal enterprises in the basin, in addition to the two named, are operating on temporary plans. Meanwhile all attention has been riveted on the Borly open pit.

Isn't it time to bring some order to all of this business and be concerned about the rebirth of the former glory of the Karaganda coal basin? And finally, it has long been time to stop showing off, "throwing dust." We use the word "dust" not only in a figurative, but also direct meaning. In the Borly coal the content of rock is often 48-50 percent. It is very inferior in value to coking coals which the association "Karagandaugol" extracts by the underground method.

By weakening attention to underground extraction and not being concerned about the further development of the mining industry, the association has essentially begun to cut the branch from under itself. It is easy to guess how this will end. Colossal losses will rise, and the state will not receive what it could and should.

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## FUELS

### BRIEFS

RAYCHIKHINSK COAL--Raychikhinsk (Amurskaya Oblast), 29 Jun--The Raychikhinsk coal field has already been called the Amur stokehole for half of a century. Its reserves have recently diminished sharply. The miner's city would have had to acquire a new occupation, but the geologists found several large fields close by. One of them is the Yerkovetskoye. Two of its explored areas alone contain about a billion tons of lignite. The geologists are conducting detailed exploration of them at accelerated rates so that the miners can start work next year. Partial operation of the Arkharo-Boruchanskiy field has begun. The Raychikhinsk coal is one of the least expensive in the country. Because of the open pit method of extraction and its high degree of mechanization, the fuel of the new fields will not be expensive either. The technology here will become more economical. The stripped rocks, high-quality clays, will not be dumped, but sent for brick production. [Text] [Article by PRAVDA correspondent Yu. Zhigaylov] [Moscow PRAVDA in Russian 30 Jun 82 p 1] 9035

MINE SUCCESS--Snezhnoye, Donetskaya Oblast--This year the miners of Snezhnoye were obliged to produce 110,000 T of coal above the plan. They kept their word with honor. The widespread competition in honor of the 60th anniversary of formation of the USSR brings good results. Since the beginning of the year, the consumers have received shipments of 80,000 T of anthracite in addition to the assignment. The technical-economic indicators have improved. Mechanized complexes and other equipment is effectively utilized here. The leading experience and progressive technology for working the thin beds are widely introduced. The collectives of the mine-administration "Udarnik," the mines "Snezhnaya," "Voskhod" and "Miuskaya" have made a weighty contribution to the general success. They are increasing the flow of above-plan coal these days. [Text] [Article by V. Vlasenko] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 21 Apr 82 p 1] 9035

HIGH COAL OUTPUT--Novokuznetsk--Having produced 35,000 T of fuel above the plan since the beginning of the year, one of the best extracting brigades from the mine "Bol'shevik" of the association "Obkemerovougol" headed by Aleksey Chigintsev is 2 weeks ahead of the production schedule. He is a bearer of the Orders of the October Revolution and the Red Banner of Labor and is a recognized leader of the Komsomol-youth collective. The eminent brigade foreman and his comrades have adopted high commitments this year: in honor of the 60th anniversary of the formation of the USSR, the miners will reach the half-million limit of annual extraction which is now only accessible to a few. In addition, the labor productivity of the worker will

be enhanced by 15 percent and the ash content of the coal reduced by 0.1 percent. In order to reach the plan, the machine operators from the start-to-finish comprehensive brigade decided to increase the load on the stoping mechanized complex "KM-81E" and increase the machine time of the combine. A high-speed schedule has been developed and is being maintained for work which permitted the monthly output for one worker to be brought to 1,162 T. There are no laggards in the brigade: the young workers are taught the leading work procedures and are supervised by field-team leader Sergey Goncharov, machine operator of combines Ivan Lodyagin, and secretary of the section party organization, machine operator Valeriy Yelanskiy. [Text] [Article by D. Mitin] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Jun 82 p 1] 9035

COAL TUNNEL--Pavlograd (Dnepropetrovskaya Oblast)--The brigade of P. Ostanin from the mine "Ternovskaya" of the association "Pavlogradugol'" completed the preMay watch with a labor record. It made a new underground tunnel for the coal extractors. A thousand meters of mine shaft were tunneled in 3 months under complicated geological conditions with section of over 9 m. Precise organization of labor and efficient use of work time became the main reserve of the collective. High-speed tunneling a month ahead of schedule afforded the way to a new coal field with output of 200,000 T. The advance development of the preparatory work has become a tradition at "Ternovskaya." [Text] [Moscow KRASNAYA ZVEZDA in Russian 1 May 82 p 1] 9035

COAL RECORD--Pavlograd (Dnepropetrovskaya Oblast), 28 Jun--The workers of the youngest industrial sector in Dnepropetrovshchina, the coal industry, had a great victory. The miners of the association "Pavlogradugol'" extracted the one hundred millionth ton of fuel from the day the new field was opened. The working of the near-Dnieper beds began in the 1960's. Then the mines "Permomayskaya," "Ternovskaya," and "Stepnaya" were opened. There are now 10 powerful enterprises already in operation, and at the end of this year, another mine will be opened. The brigade foreman of tunnelers Vasilii Bubnov and the brigade foreman of extractors Ivan Glukhoded, as well as a number of engineers and technicians were awarded the USSR State Prize for developing the new basin under especially complicated geological conditions. The specialists figure that the Dnepropetrovsk miners will produce the second hundred millionth ton in 7-8 years. [Text] [PRAVDA correspondent V. Cherkasov] [Moscow PRAVDA in Russian 29 Jun 82 p 1] 9035

DEEP WELL--Torez (Donetskaya Oblast), 7 May--The country's deepest well of more than a meter diameter was made by the method of drilling at the mine "Progress" of the association "Torezantratsit." The unique well has now reached the mark of 1,230 m from the surface. It will become a part of the giant conditioner which will improve the working conditions at the coal enterprise. [Text] [Baku VYSHKA in Russian 8 May 82 p 1] 9035

PERVOMAYSK HIGH COAL OUTPUT--The collective of the mine "Gorskaya" achieved high indicators in the socialist competition in honor of the 60th anniversary of the formation of the USSR. The enterprise miners were the first in the association "Pervomayskugol'" to fulfill the quarterly plan and worked intensively in April. The greatest contribution to the achievement of success was

made by the brigade of A. Tatarenko. By skilfully using the mechanized complex "KM-87" the members of this leading collective produce 1,100-1,150 T of coal every day. Machine operators of the combine T. Zivarnyuk and V. Kuzovlev, and electricians M. Pavlov and M. Petrenko have shown examples of intensive labor. [Text] [Article by V. Mikhaylichenko] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA 7 Apr 82 p 1] 9035

QUARRY EXCAVATORS--Yakutsk, 2 Jul--Five powerful quarry excavators were installed in the open pit "Neryungrinskiy" in a record short time, in 4.5 months. Each giant with bucket capacity of 20 m<sup>3</sup> weighs about a thousand tons. Stripping operations are underway with a broad front at this point. The sector's largest enrichment plant for the production of coking concentrate is being constructed nearby. In order to bring the open pit to rated output of 13 million T of coal per year, its builders need to strip almost 200 million m<sup>3</sup> of rock. This is why the technical equipping of the open pit is increasing at rapid rates. Dump trucks with load capacity of 120 and 180 T and the most powerful drilling equipment are being used here in addition to the EKG-20 excavators whose best crews unload up to 10,000 m<sup>3</sup> per shift. [Text] [Article by PRAVDA outside correspondent V. Tarutin] [Moscow PRAVDA in Russian 3 Jul 82 p 1] 9035

ROSTOV-NA-DONU COAL OUTPUT--Rostov-na-Donu, 18 Jun--The brigade of Hero of Socialist Labor M. Chikh from the "Mayskaya" mine of the association "Rostov-ugol'" has extracted the half millionth ton of coal since the beginning of the year. The success is even more significant because now every ton of fuel that the miners of "Mayskaya" extract is considerably more difficult than before: they have switched to working the thin beds of especially strong rocks. Because of the effective use of equipment and introduction of advanced technology, M. Chikh and his comrades produce 3,300 T of coal every day. They decided that this year, they will extract no less than a million tons of coal, and this is the ninth time. [Text] [Moscow PRAVDA in Russian 19 Jun 82 p 1] 9035

HIGH KARAGANDA COAL OUTPUT--Karaganda, 26 May--The collective from the mine "Shakhtinskaya" has worked precisely and smoothly in the second year of the five-year plan. Despite the complicated mining-geological conditions, the metallurgists have received over 80,000 T of high-quality coking coal above the plan. The illustrious collective of the third section headed by Nikolay Gladkikh has achieved great success in the socialist competition. [Text] [Article by PRAVDA correspondent Yu. Razgulyayev] [Moscow PRAVDA in Russian 27 May 82 p 1] 9035

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